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THE MANUFACTURE OF ELECTRICAL CONDUCTORS.

Covering.—From an electrical point of view, a conductor and its covering must in general present diametrically opposite qualities. The former cannot be too good a conductor, and the latter can never be too good an insulator, since its purpose is to prevent a passage of the current when two conductors or two parts of the same conductor come accidentally in contact. Such covering will vary in thickness, and will be more or less resistant, according as it will or will not have to undergo the inclemencies of the weather or mechanical shocks, or according as it is to be wound once for all upon the bobbins of an apparatus under cover.

We may distinguish the wires as follows:

1. Overlaid wires, or those simply covered with a layer of silk or cotton wound around them like a bandage.

2. Braid-covered wires, in which the covering, forming a true tube of braided silk or cotton, constitutes a much firmer envelope than does the preceding, and one which is capable of resisting repeated friction. The conductors of the telephone and medical apparatus are types of this kind of conductor.

3. Cables, whose covering is always multiple and more or less complex, but which always comprises at least a primary, electrically insulating covering, and a second one whose purpose is to serve as a protection to the other.

4. In submarine cables, which form the last of the series, the protecting layer is itself covered with a third envelope, formed of iron wire, called an armor, and designed to support all the tractive stresses to which the cable is submitted. We shall omit reference to the manufacture of submarine cables, and confine ourselves to that of wound and braid-covered wires, and of simple cables that are also known as electric light cables.

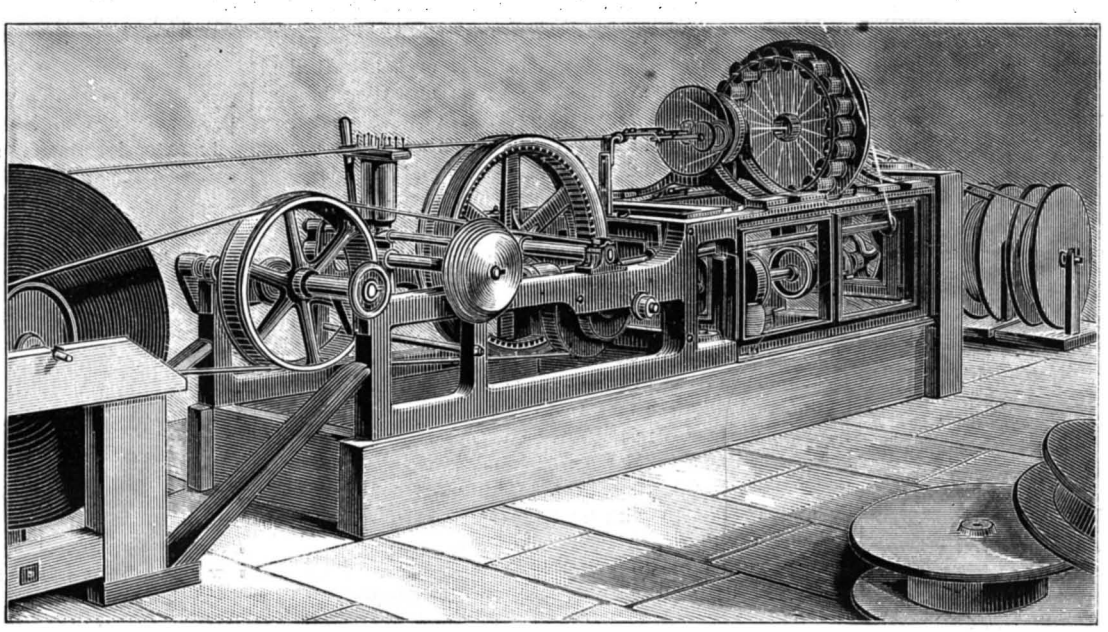
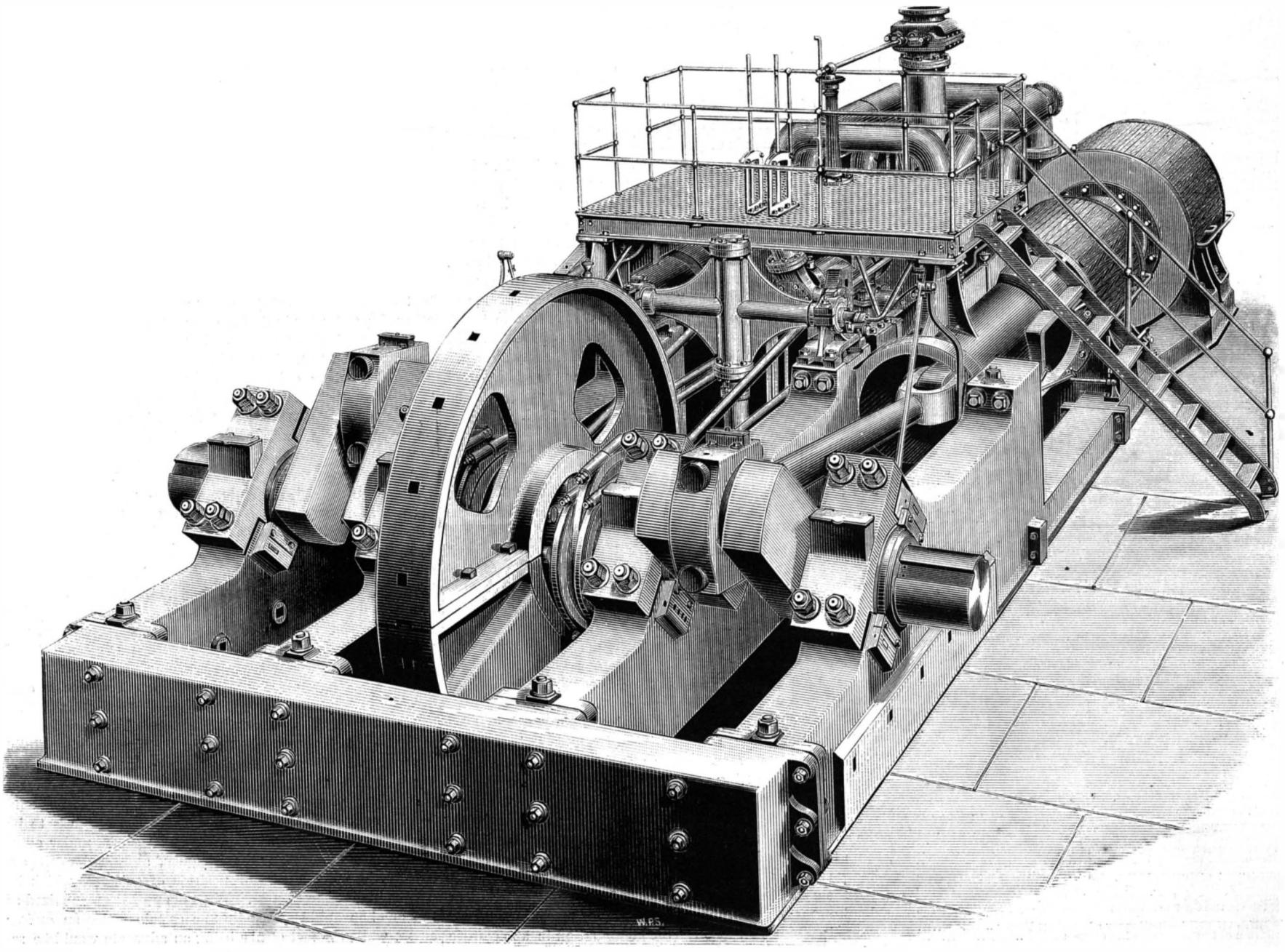


Fig. 1.—ELECTRIC CABLE MACHINE.

Overlaid Wires.—The winding of naked conductors is effected by means of machines called whipping wheels. The number of bobbins in each machine varies with the size of the wire to be covered. Thanks to the kindness of Mme. Bonis, who has kindly shown us in detail the interesting process of manufacturing electrical conductors, we are enabled to place before our readers a representation of one of the twenty-four bobbin whipping machines of the most recent style, and furnished with all the latest improvements that long practice alone could suggest. This machine (Fig. 3) consists in reality of twenty-four distinct apparatus, which are mounted upon a single frame and actuated by one and the same gearing. One person, a woman, suffices in general to start and attend to these twenty-four bobbins. Each of the latter is capable of covering about 400 meters per day, and the product of the entire frame is therefore nearly 10,000 meters per day. The wire to be covered is placed upon the bobbins at the upper part, descends vertically, bends at right angles to run over pulleys placed behind the frame, and

(*Continued on page* 66.)



IMPROVED REVERSING RAIL MILL ENGINES.—[See page 70.]

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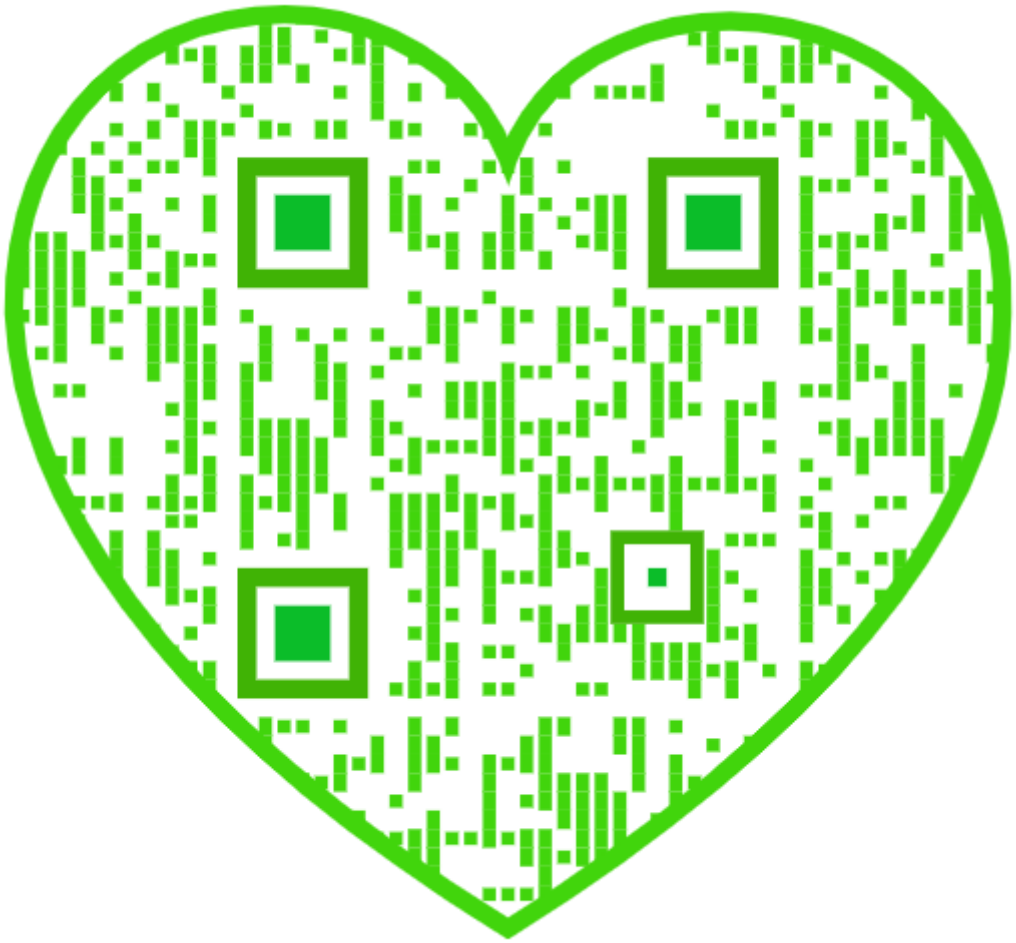

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NEW YORK, SATURDAY, AUGUST 4, 1883.

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A BRAVE LIFE GONE OUT.

Captain Matthew Webb, the famous English swimmer, was drowned in the Niagara Rapids, July 25, in an attempt to float "the angriest bit of water in the world," as he styled it. His attempt was not made wholly for notoriety, for no extensive advertising was done, and no means taken to secure a large number of spectators. It was not made for money. Probably less than 200 persons saw this brave man go to his death. But he had great confidence in his powers of endurance, for he had swum the English Channel from Dover to Calais, a swim of nearly twenty-two hours; he saved a sailor by jumping overboard in the mid-Atlantic in a storm, and was the recipient of a gold medal from the Royal Humane Society, and of other testimonials, for his skill and bravery. He came to this country in 1879, and besides giving exhibitions of his own skill, gave lessons in swimming. He was only 45 years old when the remorseless waters drew him out of mortal sight.

Some time before the fatal attempt he stated that he felt himself strong enough and skilled enough to swim the Niagara Rapids and get through alive, in defiance of the stories told by the inhabitants of the adjacent localities as to the danger of these turbulent waters. He even described in detail his plan of avoiding the Scylla and Charybdis of rocks, and the dress he would wear. He had calculated on the methods he would adopt in buoying himself, the use of "breast strokes" and "overhand strokes," all his plans being well thought out beforehand, and his failure should be attributed to his lack of knowledge of the awful hell of waters into which he ventured, which outvie even Poe's horrible description of the "Descent into the Maelström."

Only three persons can boast of having shot the rapids, and they did it in a steam vessel, the Maid of the Mist, in 1861, under circumstances of such extreme peril as may best be understood by the fact that she came out of the ordeal with loss of smokestack and with such other injuries as made her appear like a wreck when she landed on the other shore, miles below her starting point. And this success was made by a boat built to withstand the surges below the falls, and specially lightened for the shoot, with a one hundred horse power engine to propel her. If she barely came out of the test, battered and abused by the terrible waters, it is no wonder that a brave man lost his life with only his own unaided physical stamina and mental courage to back him.

COMPLETION OF THE GREAT LYMAN-HASKELL GUN.

The twenty-five ton gun, twenty-five feet long, which has been in process of manufacture during the year past by the Reading, Pa., Iron Company, is at last completed, and is a splendid piece of workmanship. This remarkable weapon has the following peculiarities of construction:

Hanging from the under after part of the gun are four large protuberances arranged in a line, each something like a cow's bag. These protuberances contain pockets for holding powder, and they communicate with the bore of the gun. The latter is charged at the breech with eighteen pounds of powder, against which the projectile rests in the ordinary manner; each of the pockets is intended to contain twenty-eight pounds of powder.

The firing of the breech charge starts the projectile, which is successively accelerated, on passing the several pockets, by the firing of the powder charges contained in them, which are set off by the flame within the cannon. In this way five successive charges are made to act against the projectile, which leaves the gun with a tremendous velocity. It is expected that this cannon will revolutionize the art of gunnery; it is believed that it will carry its ball twelve or fifteen miles, and go through iron plates two feet in thickness. The new gun is now on its way to Sandy Hook, N.Y., where it is soon to be tested before a board of army and navy officers, under a special Congressional appropriation. A full, illustrated account of this novel invention was published in the SCIENTIFIC AMERICAN of January 28, 1882.

THE TELEPHONE INTERFERENCE CASE DECIDED.

The Examiner of Interferences at the Patent Office, Mr. J. B. Church, has lately rendered a decision in the long contested telephone case, in which the parties interested were Bell, Gray, Edison, McDonough, Dolbear, Boelker, Blake, Irwin, and Richmond. We understand that this decision disposes of some eleven cases in all, in which the above parties were represented. These cases have been pending before the Patent Office since 1878, and were argued before the Examiner about a year and half ago.

It has been necessary for the Examiner to go over a vast amount of testimony, and it is understood that he has performed the duty with greatest care; his decision is stated to cover nearly seven hundred pages of manuscript.

Priority of invention is awarded to Bell for the art by which oral conversation or sounds of any description can be telegraphically transmitted; also for the improvement in the art of transmitting vocal sounds or spoken words telegraphically; also for the acoustic telegraph, including sound producers as well as reproducers on armature plate, the electro-magnet for the same, and a closed circuit passing from the helix of such electro-magnet to the source of undulatory electric energy; also for the telephonic transmitters and the combination in one circuit of two or more disks or diaphragms; also for the combination for rendering audible acoustic vibrations: also for the combination in an acoustic telegraph of an electro-magnet and a polarized armature, and the combination in an acoustic telegraph of an armature plate polarized by induction, a resonant tube, and an electro-magnet and circuit connections.

Priority of invention is awarded to Edison, although he did not claim it, for the transmitter, consisting of the combination in an electric circuit of a diaphragm and a liquid or equivalent substance of high resistance, whereby the vibrations of the diaphragm cause variations in the resistance of the electric current; also for the combination in a telegraph instrument operated by sound of two or more electrodes placed in an electrolytic liquid, and operating to increase and decrease the resistance of the electric circuit by the movement derived from the diaphragm; also for a spring forming or carrying one electrode, and constantly pressing against the other electrode and the diaphragm to maintain the required initial pressure between the electrodes and yield to the movements of the diaphragm.

Priority of invention for "a telephone receiver, consisting of the combination in an electric circuit of a magnet and a diaphragm supported and arranged in close proximity thereto, whereby sounds thrown upon the line may be reproduced accurately as to pitch and quality," is awarded to McDonough.

OLD BUILDING MATERIAL.

An extensive trade in second hand building material has been carried on uninterruptedly in this city for fifty years, and is largely supported by builders and joiners. The stone and brick of an old building is used in the construction of a new one, the lime-whitened bricks making the inside of the outer walls and the partitions, and the stone going into the foundations. But it is not generally known that the inside woodwork is used again, frequently without radical alteration. Many builders prefer this old timber because it is thoroughly seasoned, having been defended from the weather and been subjected to the influences of a measurably even temperature for years. The richer woods which are admired for their color acquire mellower tones by age and become more valuable as the years pass. Everybody knows that furniture of mahogany and rosewood that has outlived several generations is much handsomer than that made from new wood. But it has an added value as mere material. An article made from the old wood will retain its integrity in all its joints; its shrinking days are over. For the same reason the timbering, wainscoting, and flooring of old buildings has an added value, although its selling price is less than that of new material.

THE RELATIONS OF PATENT EXPERTS TO THE COURTS.

When a case involving scientific principles comes up in the courts the custom is for each side to call to their assistance scientific experts. These are men who, on account of education and profession, are admitted to possess a peculiarly full knowledge of the scientific points involved in the issue.

They occupy an anomalous position. They are summoned nominally as *amici curiæ*, or friends of the court, to assist in its deliberations, and give it information in the special knowledge required to dispose of the questions that come before it. This assumes that they are quite disinterested and indifferent to the ultimate issue. Yet each side engages its own expert, and each of these experts takes as favorable a view as possible of his own side and runs down the other as much as possible. Although their compensation does not depend on the final decision that is reached, if they were to act as judges and not give their own side the benefit of all doubts, their occupation would soon be gone. The fact that they are in some sense advocates is recognized by the court. The fact that they are retained by one or the other side to testify in its favor is admitted.

Because it is always possible in this special class of suit to engage experts to testify on either side, a certain degree of distrust for their opinions is often expressed. The great truth is overlooked, that in not one case out of a hundred are the principles so clear that something is not to be said on both sides. Yet the complaint is continually made that the expert is too much the advocate.

Among lawyers who practice in patent suits different views of this subject obtain. Some say that they do not believe in experts. They would prefer to conduct their suits without them. The general custom is all that makes them retain them. These lawyers will often be found to be among the best of their class. They will have so good a knowledge of the principles of science, as to quickly grasp the mechanical points of a case. They could act as experts themselves, but custom requires that they should have some witness, one obliged to tell the whole truth, as a supporter of their views. Such a supporter has been found to have great weight with the court, and to be of much influence in controlling its decision.

Some lawyers propose another system. They say that the expert should be engaged to present the views of the counsel to the court. They should not be witnesses. Their statements should be an exposition in understandable and correct form of the views of the counsel. This statement should be given as a one-sided view, and should not profess to be disinterested. Finally, it should not be given under oath. This certainly is meeting the difficulty, and justifies the expert in the most advanced position of advocate which he may be inclined to assume. Were his position recognized as this one he would still remain to a certain extent an *amicus curiæ*, while the fact of his being an advocate would be recognized as proper and right. At present this is practically

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his position. except that his testimony is given under oath. This places a great restraint on his direct testimony, and enables the opposing counsel to test the validity of his views by cross-examination.

There is yet another way of disposing of the difficulties of the case. It is to have experts called by the court directly, and paid by it to assist it in its deliberations. At present experts are to all intents and purposes assisting counsel. This would make them assisting judges. The idea of thus using them is quite a popular one. Many of our best lawyers advocate it. The expert would occupy a wholly disinterested position, and the decisions he reached would have every chance of being equitable and just. In this suggestion there is much that is attractive, and in a more advanced state of society it would seem worthy of being carried out.

But the same necessity which calls for advocates and lawyers to argue separately each his own side of a case calls also for experts on the separate parts of complainant and defendant. When two people come to an issue they do not go before a court and accept its unaided judgment as infallible. Each side engages its own counsel. These are officers of the court, yet are not prohibited by that fact from taking one side or the other of a case. Their duty is to do so, and be as one-sided as possible, and to carry every possible point in their client's favor. No matter how able the judge may be, his time is too important to be devoted to looking up authorities and to studying each from the books. He sits in judgment upon the views presented him by counsel. If they are properly put forward, he in many cases can decide the case without leaving his seat. Thus business is expedited, and the main expenses of a suit are borne by the interested parties and not by the government.

Were the court to call an expert for its guidance in special suits, and were the parties in the suit to have none, the position would be analogous to that of a court sitting in direct judgment or arbitration, with no lawyers to advocate the causes of those appearing before it. There would be no summary of the scientific questions presented. This work would fall upon the court and its expert. Business would be delayed, and a very considerable expense be placed upon the court. It would not be much better to dispense with experts than to dispense with counsel.

At present the scientific views are well presented. The experts give them in detail. They are formulated after discussion with their counsel. The counsels in their briefs and arguments summarize them, and present to the court their most salient and applicable points. The expert has been debarred by his position of witness from arguing the case. Any tendency he may exhibit in his testimony toward such a course is met by objection from the opposing counsel. All he has been able to do is to give his views as a specially qualified witness. The counsel completes the work the expert has begun. He can give the fullest license to his reasoning powers in proving his case. The argument is the supplement of the expert's testimony, and has therefore to follow it very closely. A departure from any of the views brought forward by the expert will be made to tell forcibly against the same side.

Thus it will be seen that the lawyer and expert must work hand in hand. One cannot go ahead without the other, the witness being the most restricted on account of his position. While his testimony must bear the stamp of independence, it will necessarily be partial. As this partiality is known and recognized as an attribute of expert testimony, it gives the professors of it a known standing. They are considered with justness as specially educated witnesses retained for the purpose of presenting the views of one side to the court. They should not be considered as sailing under the false colors of a pretended disinterestedness.

THE CATERPILLAR AND ITS ENEMY.

The ordinary caterpillar is covered with bright yellow hair, has a deep brown stripe down the back, has four tussocks, or tufts, of hair in a row back of its head, and has two small red warts on the two segments next the last. From the extremity projects a single pencil of hairs, and from the head radiate two pencils having the appearance of horns. The eggs from which the caterpillar, or grub, is hatched are small, white, and hard.

When the grub emerges it commences to feed, bending all its energies toward gorging itself. It grows rapidly, shedding its skin several times, and when full sized, or full fed, as it is termed, is ready to spin its cocoon and enter the pupa or chrysalis state. The hairs of the body are woven in the cocoon in addition to the thread spun. The female case is longer and thicker than that of the male. From the cocoon emerges the moth known as the *Orgyia leucostigma*. The females are wingless, having only rudimentary wings, and do not travel any distance. The males are smoke colored with spotted wings. The female lays about 230 eggs, covering them with gluten and a silk which she spins, so that the nest has the appearance of a little tuft of white cotton. She sometimes draws leaves around the nest so as to completely close it, excluding the rain and deceiving the eyes of the birds.

The ichneumon fly is a parasite, its prey being the caterpillar above described. The female deposits its eggs on the back of the pupa in the cocoon of the caterpillar. When the egg is hatched the grub works its way down into the pupa, on which it feeds. When full fed it spins its cocoon in which it completes its transformation, coming forth as a fly. The fly is slim bodied, about one-half an inch long, and of a black color. In some species the antennæ and legs are red, but in the one under consideration the antennæ are black with the exception of the center, which is white.

There is no way by which the worm-pest can be got rid of, and although this fly aids in the work of destruction, his numbers are too small to make his efforts appreciable. Undoubtedly the best way yet devised is to brush off and destroy the nests of the moth. Generally they are easily seen, and when it is remembered that each one contains more than two hundred eggs, it is easy to conjecture what an inroad one man could make in the ranks of the caterpillar.

SKETCHING FOR MECHANICS.

While the value of a knowledge of mechanical draughting to a mechanic is indisputable, there is a sort of free hand drawing, or sketching, that is also useful. The faculty for its practice may be innate, and in that case but slight instruction is necessary to enable its possessor to illustrate his thought far better than he could impart it verbally. But even those whose natural tendency does not impel them to sketching as explanation can get enough facility by practice to make themselves understood readily.

Probably nothing is more difficult to explain and exhibit by words alone than mechanical construction and mechanical movement. It is not only difficult for the narrator, but also for the listener. The memory must hold all the points of the information in contact ready to make a completed idea at the climax. But an appeal to the eye, however crudely made, presents the entire image at one view without any laborious action of the mind. And it is a noticeable fact that those mechanics who are of an inventive, improving, and originating turn of mind are most apt with pencil and paper, or chalk and slab. To them the mechanical idea has received a form in their own mind, and by a partial representation they seek to impart their knowledge to others.

The practice of sketching as illustrative of verbal statement is an excellent one for mechanics generally to acquire. If one has not the natural impulse in this direction, a few lessons in free hand drawing will not be amiss. Some of the best of James Watt's improvements derive their historical and mechanical value from his rough sketches, which told much more plainly than his equally crude English the operations and conclusions of his constructive mind. In the annual meetings of mechanical engineers there is seldom a paper read that is not illustrated by the author, at the time of reading, by the blackboard and chalk, or else it had been made visible by prepared cartoons, or possibly lithographed charts. Shop work also demands the ready hand at sketching. There are many jobs which do not require the preliminary preparation of the draughting room, that are greatly expedited if the foreman has a facility with pencil, crayon, or chalk.

PICKER FIRES

A writer in the *Textile Record* for July asserts that a fire cannot be started in a picker house by sparks of fire from the picker igniting the cotton; "no spark from a picker ever fired a mill or ever can be made to set fire to anything." As the writer well says, "these are tolerably broad assertions." Nevertheless, he offers as evidence in favor of their truth the result of experiments which he made, such as producing a shower of sparks from a brick held against the beater, into which was thrust successively shoddy, cotton fiber saturated with benzine, and even lucifer matches. The open hand held against the stream of sparks felt no pain.

The sparks from an emery wheel do not burn the hand, nor ignite the workman's apron or overalls, but each particle is a minute coal of fire, and under favoring circumstances will ignite inflammable and explosive materials. Sparks from a flint and old file will ignite tinder, charred rags, and punk. But to do so the sparks must be protected from the wind. Possibly the experiments made by the correspondent were made with the beater box uncovered, and the lint and other materials and the shower of sparks were exposed to the blast from the revolving beater. It is probable that particles of grit, nails, bits of wire, and similar materials do run the gauntlet of the picker beaters frequently without inciting a blaze, as the condition of the waste proves; but there may come a time when, all the conditions being favorable, the destructive spark will do the work.

The writer attributes fires to the spontaneous combustion of oily waste which is put into the picker house. If such a reprehensible practice is followed, or allowed by a mill superintendent, he is certainly an unfit man for his place.

It is not always possible to ascertain the cause of a fire that starts in the picker room, but that mills are burned by fires started there is unquestionable. Mill owners show their belief in the danger from this source in erecting detached fire proof buildings for picker houses, and it is doubtful if a single mill owner could be found so confident in this correspondent's belief as to allow experiments be made in his picker house by passing through the rolls to the beater nails, wire, or grit with the cotton. At all events, no degree of the vigilant caution now practiced to prevent these foreign substances from reaching the picker should be relaxed because cotton lint once did not take fire from a shower of sparks.

AN artesian well sunk by the Pierce Well Excavator Company for the Manhattan Elevated Railway Company, at 128th Street corner 2d Avenue, in this city, has a depth of 250 feet, and yields 250 gallons of water per minute.

How to Raise Big Crops.

It has often been asserted by advanced agriculturists that if wheat, either spring or winter, is sown in drills, far enough apart to admit of using a horse hoe between the rows, both to keep down weeds and loosen and aerate the soil, the yield might be increased to a marvelous extent more than it now is in this country.

In proof of this, a recent observing and intelligent traveler in Belgium gives the mode of culture there and the yield, which sometimes, with very favorable weather for harvest, reaches as high as 160 bushels per acre. This is one of the most fertile, prosperous, and most populous countries in the world, supporting 481·71 persons to the square mile, against 13·92 in the United States and 216·62 in Germany. Winter wheat is a staple crop there on their high priced small farms of only an acre or two. The land is highly manured in Autumn, well harrowed several times, and got into the best possible condition. The grain is sown in the fall in seed beds, very thickly on the highest and best location, where it is not likely to be winter-killed, or injured by any casualty, such as overflowing or drowning out, or smothering under the snow.

In the spring the main fields are again dressed up and marked out in drills the proper distance. When the wheat has grown sufficiently to be moved, it is thinned out by being taken up, separated from the thick stools, and planted in the drills with a tool called a dibble, which makes a hole the proper depth, into which the wheat roots are inserted, pressing the earth tight against them with the foot. This work is usually intrusted to half grown boys and girls, a man sorting out the wheat plants in order that those of the same size may be placed together, that the field may grow even and regular.

When the plants have commenced growing, the soil is thoroughly and constantly stirred, either by means of hand or horse power. Every weed and all foreign plants are destroyed, and nothing but what is wanted, the article itself, is allowed to grow. There are very seldom any extensive failures of crops thus carefully and scientifically grown. The yield is a quantity never imagined or heard of in this country, and the crop always and surely pays the cultivator.

It is asserted that such pains would not pay to apply to crops in this country. But do we not go to the opposite extreme? Has it ever been tried here? It certainly would pay satisfactorily if applied to choice varieties in small quantities, about to be used for seed. It is certainly better to till one acre and get a crop now raised on four acres, than to try the four and only raise half a crop, which is now so often the case here.—*Milling World.*

The Water Jet.

The *Annales des Travaux Publics* describes the method used in sinking the piles for the foundation of the Palais de Justice at Brunswick (Prussia).

A framework with hoisting fall somewhat similar to the ordinary pile driver was used in placing the pile in position ready for sinking; two tubes, each 2 inches in diameter, with the lower ends bent inward toward the point of the piles, were attached to the piles by iron staples; at the upper end each pipe was connected by a short section of rubber hose to other pipes connected with the city water main, which water supply was in this case under a pressure of four atmospheres. The piles usually sunk by their own weight into the hole formed by the water jet, as soon as the valve was opened, making connection between the tubes on the pile and the water main. To hasten the rate of settlement, a vertical iron bar 3 feet long was set into a hole bored in the head of the pile, and upon this were placed iron weights of 200 pounds each, as the resistance might require.

Piles 12 inches in diameter were sunk in this way to a depth of fifteen feet in 10 minutes' time. The least time required for a depth of 15 feet was 2 minutes, the longest time for the same depth was 30 minutes. As long as the water jet was in operation at the foot of the pile it was possible to give the pile rotary motion, and thus facilitate the descent; but as soon as the jet was stopped the pile became immovable. As a proof of their stability a dead weight of 50 tons was applied to some of them, and it was found that their resistance was entirely independent of the time consumed in sinking them.

To sink 20 piles by this method required the use of about 2,000 gallons of water; 7 or 8 laborers were employed, and one gang put down from 6 to 14 piles per day.

Copper for Roofing.

In speaking of the cost of building materials an architect recently suggested the use of copper instead of galvanized iron or "terne" sheets for roofing purposes. He said that copper costs only about double the price of tin, or iron, for the same area of roof, that it is practically indestructible by time, and that even if the building it covers is pulled down the roofing material possesses an absolute value. The price of copper has seriously declined within the past year, and if the supply continues to augment much more, the metal will soon be as cheap as tin.

COTTONWOOD lumber seems to be coming into large use, and for dry goods cases, starch boxes, and similar purposes it is said to be well adapted. One establishment in Ohio, it is said, works into boxes as many as two million feet of lumber annually. For building purposes it is not well adapted, as it is apt to swell and shrink with the condition of the atmosphere.

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THE MANUFACTURE OF ELECTRICAL CONDUCTORS.

(*Continued from first page.*)

then passes into the axis of other bobbins that are filled with silk and have a rapid rotary motion. The silk which these bobbins carry then winds around the wire, which is moving forward with a regular motion under the action of the pulleys around which it runs. These pulleys are shown toward the center of the frame. After leaving them the wire winds around bobbins in the upper part of the frame. By properly proportioning the speed at which the wire is carried along, and that of the bobbins' rotation, one can vary at will the thickness of the insulating layer, which is formed here of a continuous band of silk or cotton making a certain number of turns to each centimeter of wire covered. All transmissions of motion are made by the aid of small cords; and a series of conical pulleys that correspond to each bobbin permits of regulating the speed with which the wire moves forward, this varying between 30 and 60 meters per hour.

The bobbins upon which the wire is wound likewise present special arrangements that are very interesting. As may be conceived, the length of wire that they are capable of taking up at one revolution depends upon the quantity that they already carry, since the diameter increases as the bobbin fills. If the latter possessed a regular motion, it would wind badly at the beginning and would infallibly break the wire at the end. All this is prevented by carrying it along *by friction.* To this end the diameter of the pulleys is calculated so that the speed shall be a little greater than that that corresponds to the empty bobbin, that is to say, to the least advance per revolution. The transmitting cords, after passing over the pulley of the bobbin, support a small roller furnished with a hook from which are suspended weights for regulating their tension. These weights are shown at the bottom of Fig. 3. When the tension of the covered wire exceeds a certain amount, the cord *slips* on the pulley of the bobbin and fails to carry it along. There results from this a motion which is partly a sliding one, and an excessively regular winding of the wire, since the tension is constant and is regulated by the weight suspended from the friction roller.

It now becomes a question of distributing the wire throughout the length of the bobbin. To this end, the bobbins are mounted upon a frame which is movable horizontally. A series of gearings and a cam (represented to the right in Fig. 3) give this frame a slow and regular backward and forward motion. The travel of the frame is equal to the internal length of the bobbin between its two flanges, and the winding of the wire is thus effected very uniformly. The travel is changed, according to the diameter of the wire, by modifying the train of gearings. It may be seen, in fact, that the relative speeds of the different parts of the machine depend upon the diameter of the wire and the nature of its covering, although the principle is the same for all. The 24-bobbin machine is designed especially for wires of small diameter that are always covered with silk. For wires of medium and large diameter the machine is provided with a less number of bobbins of larger size. In Fig. 3 may be seen what appear to be cylinders of different sizes, divided off by black lines. These are composed of bobbins, each carrying a like quantity of silk. Before beginning operations, there is thus stored up in a tube which is traversed by the wire the number of bobbins full of silk that are necessary for the entire work. When one of these bobbins is empty, it is taken off and replaced by a full one from the stock in reserve. When the wire is to be covered twice, it is, with its single covering, passed into a second machine, and the winding is effected in a different direction, and so as to obtain a crossing of the threads in order to give greater firmness. For medium wires we have seen in Madame Bonis's establishment machines that performed the two opposite windings at a single operation.

Braid-covered Wires. — The machine for covering the wire with braid is termed, in the language of the workshop, a "waltzer." Fig. 2 represents one of these apparatus in the act of covering an electric light conductor. The motion of the wire is here the opposite of that which it has in the overlaying machine. The uncovered wire enters through the lower part, while the covered is stored up in the upper part. The braiding constitutes a true fabric of more or less compactness. The number of threads that compose it varies between 12 and 48. The "waltzer" shown in the cut is arranged for 48 bobbins. These latter, which are arranged vertically, are grouped in twos, and are carried along by 24 disks that revolve alternately in one direction and the other through gearings, and that are arranged upon a circumference whose center is occupied by the wire.

The wire to be covered passes through the center of this circumference, and all the threads, in rejoining the point where the braiding is performed, form a sort of conical surface which is well shown in the figure. The bobbins containing the thread of each braid are mounted upon vertical spindles. Owing to a mechanical combination which is as simple as it is ingenious, these spindles change disks at every half revolution and traverse the entire surface of the 24

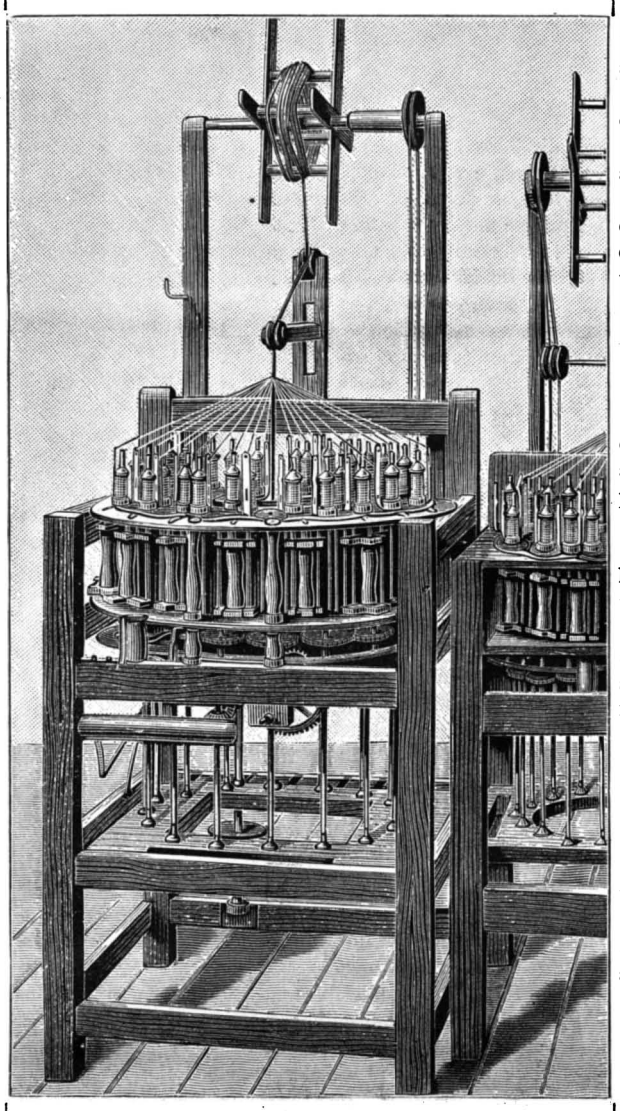

Fig. 2.—THE WALTZER, A MACHINE FOR COVERING ELECTRICAL CONDUCTORS.

disks, describing in doing so a regular curve formed of small semicircles that are alternately external and internal to the large circumference formed by the 24 disks. Half these bobbins effect this movement from right to left and the other half in an opposite direction. The result of these combined motions generally is that each of the threads taken isolatedly, during one entire revolution, successively crosses all those that are running in an opposite direction

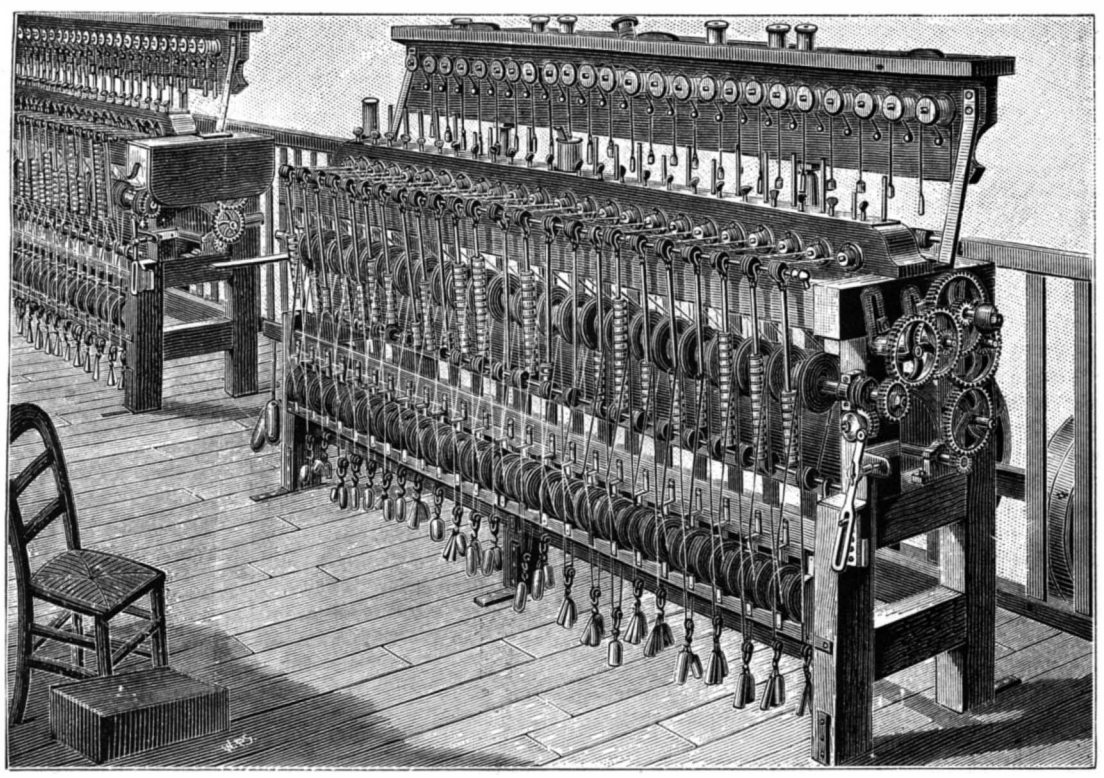

Fig. 3.—MACHINE FOR WHIPPING SILK OR COTTON AROUND CONDUCTORS.

while at the same time remaining parallel with all those that are running in the same direction with it, and passing alternately above and below two successively crossed threads.

The "waltzer," then, realizes automatically what is done by hand in ordinary braiding, and is identical in principle with the apparatus made use of by trimming makers in the manufacture of watch cords, etc. The mean production of one of these apparatus is 100 meters per day.

Electric Light Cables.—The English cable machine (Fig. 1) is capable, according to requirements and to the arrangement of its parts, of producing several successive or simultaneous effects, and, consequently, of furnishing a number of types of cables. There are three phases in the operation that it performs: (1) the uniting of several wires into a single strand which is afterward to be covered with India rubber or gutta percha, according to the application to be made of it; (2) the covering of the conductor with a fabric to protect the insulating material; and (3) the covering of the whole with a band of protecting material, by an operation analogous to that performed by the overlaying machine.

These two latter operations are always identical in principle, the conductor being carried along with a uniform motion, while the covering is given a rapid rotary motion around it.

When the cable is not provided with the intermediate covering, the bobbins are removed from the disk, and the conductor then receives only the external bandage. Sometimes the machine is used merely for twisting wires into a single strand, the wrappings being dispensed with.—*La Nature.*

A Cotton Seed Oil Manufactory.

Cotton seed, which only a few years ago was considered valueless by the planter, has become a very important product, its oil being now used for a great variety of purposes, and immense establishments have been erected in different parts of the country for its manufacture.

The Columbus (Ga.) *Sun* closes a long description of a new oil mill in its city with the following description of how oil is made: The seed are first put into a hopper, where they are fed to the cup elevator by a screw conveyer. They pass through a sand screen which takes out the sand, and are then passed over a shaker and fan to take out all heavy substances which may be found in the seed. From here it is taken to the linters, where it passes through three 16-saw gins and is freed from all lint. From thence they are all carried by a belt conveyer to another elevator, and emptied into the huller, where they are chopped, hull and all. After passing through the huller they are again elevated to the third story, where they pass through another screen. Here the hull and meat separate, the meat going back to the second story, where it passes between large rollers, and they are well compressed. They are now ready for cooking, and are conveyed to the second floor into six heaters. After a certain length of time the plugs are drawn from the heaters and the contents are emptied into a bin. They are then taken out and put into small sacks, and placed between mats and again pressed. The oil is then emptied by means of a large pipe into the ground tank. By means of a pump it is forced into two large settling tanks in a separate apartment, and after two or three days it is drawn off into barrels and is now ready for shipment. After being cooked, put into sacks and pressed, the oil cake remains and can be used to advantage after being ground into meal. From it a splendid fertilizer can be made; besides, it is fine for stock feed.

Bathing and Cramps.

A sad instance of fatal cramp from bathing lately occurred at Durham, says the London *Lancet.* A fine young fellow, a trooper in the 3d Dragoon Guards, then on the march from Edinburgh to Manchester, took advantage of the night's halt to have a dip in the Wear near that city. Being strong and a good swimmer, he took an oar, at which he worked for some time in the sultry evening till he came to deep water, and in a suitable place took his plunge. That he was immediately seized with cramp is evident from the statements of his companions, who, alarmed at his cries, hastened to render assistance, but he had sunk before they reached him, and he never rose again. When the body was recovered a considerable time afterward, it bore every evidence of the cause of the disaster. It was described as being "twisted"—that is, contorted; while the vessels of the head, especially in their gorged condition, pointed to congestion, in fact, to stagnation of the circulation! That this young soldier lost his life by bathing when in an overheated condition is quite clear. It would be well if soldiers and civilians would remember the lesson conveyed in the classical case of Alexander, quoted by Dr. Jones from Quintus Curtius, viz.: "It was in the middle of one of the hottest days of a burning summer that Alexander arrived on the banks of the Cydnus. The freshness and clearness of the water invited the king, covered with sweat and dust, to take a bath. He stripped himself of his clothes, and, his body all in a sweat, he descended into the river. Hardly had he entered when his limbs became suddenly stiff, the body pale, and vital heat seemed by degrees to abandon him. His officers received him almost expiring in their arms, and carried him senseless to his tent.

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THE TELESCOPE AT THE TROCADERO OBSERVATORY.

We represent herewith one of Mr. Leon Jaubert's telescopes arranged and constructed especially for the popular observatory of the Trocadero, and which has now been in daily use for nearly three years.

It is a short focus instrument, having only half the focal length of those formerly constructed by Mr. Leon Foucault. Its optical part consists of:

1. A silvered glass reflector, 16 centimeters in diameter, placed in the bottom of the tube. 2. A total reflection prism designed for sending the luminous fascicles, as in all Newtonian telescopes, to the lateral part of the instrument.

3. An ocular formed of several glasses arranged like the different lenses of a compound microscope, and giving an upright image.

It is through this ocular that the observer looks at the image given by the reflector.

The different pieces that go to make up the mechanical part produce, as a whole, a very beautiful effect. The instrument appears to be very light, while in reality it is very solid. The base rests upon a wooden frame mounted upon three rollers. The instrument is accurately leveled by means of three leveling screws. The base supports an open-work frame which carries a horizontal axle that may be called the axis of latitude. This serves for fixing, by means of a set screw, the horary axis on the latitude of the place where the observations are made. The horary axis is connected with the circle and horary wheels. The disk of the circle is likewise provided with a frame that carries the axis of declination, this latter being formed by the two trunnions belonging to the ring that surrounds the telescope tube. One of these trunnions carries a graduated circle accompanied by a vernier and called the circle of declination, and the other, a toothed wheel which is actuated by an endless screw.

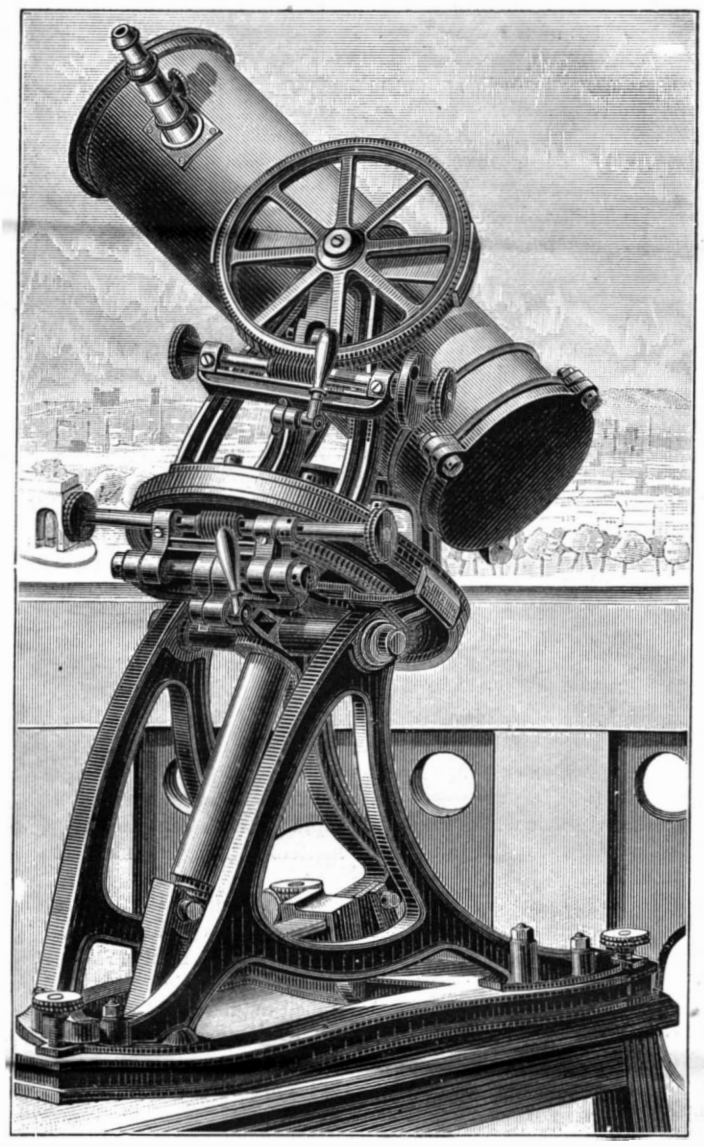
The endless screw that actuates the horary wheel and the one that actuates the declination wheel are each mounted upon a hinged frame, which permits of engaging them instantly with the corresponding wheel, or of separating them in such a way that the instrument may revolve freely around the horary axis and that of declination.

In both its optical and mechanical parts this telescope presents some very interesting details.

Mr. Jaubert has placed in the opening of the instrument a cap which carries a circular glass whose surfaces are perfectly parallel and optically finished, and which is designed for protecting the silvering of the reflector from dust and atmospheric moisture. When it is desired to make an observation of the sun, this cap is replaced by a second one which carries a glass that is silvered upon one of its surfaces. The solar rays traverse the pellicle of silver, reach the parabolic reflector in small quantity, return in a condensed fascicle toward the prism, and, on reaching the eye of the observer, have but slight intensity. The rays thus weakened scarcely ever distort either the reflector, the prism, or the lenses of the eye piece. The mass of air inclosed within the telescope is also less superheated at the focus, and remains calm. Not only are the images better, but the reflector, prism, and eye piece are no longer liable to breakage, and the observer runs no risk of being blinded.

The reflector is mounted in a tube whose form merits notice. The external and lateral part of this tube, as well as the internal part of the telescope tube into which it is introduced, are both formed of two circular zones of the same diameter, one convex and the other concave. This simple arrangement has the advantage of permitting of the easy introduction of the reflector into the instrument, and of centering it instantly by tightening one or the other of the three bolts that connect the lugs of the tube with those of the breech piece. In order to remove it, it is only necessary to right the body of the instrument and take out the bolts, when the reflector tube will drop out of itself.

The telescope is provided with a revolving eye piece which carries four lenses, one of which is used as a finder, while the others give different magnifications. Mr. Jaubert has also devised for his telescopes, as well as for his microscopes, different styles of binocular eye pieces. He has also applied to the opening of his telescopes a special optical combination designed to bring within the field of the instrument stars that are very remote from one another, so as to compare the intensity or color of their light, or to compare the diameter of the sun and the moon, or the diameter of Venus, Jupiter, and Saturn when these different celestial bodies are no farther than 100, 120, or 130 degrees apart. The popular observatory makes use of telescopes of from 20 to 30 centimeters diameter, and these are employed by the amateurs who are attending the course of lectures on astronomy at the institution.—*La Nature.*



THE TELESCOPE AT THE TROCADERO OBSERVATORY.

THE export of ostrich feathers from the Cape last year was unprecedentedly large. The prices obtained were enormous.

Zinc Blende at Niagara Falls.

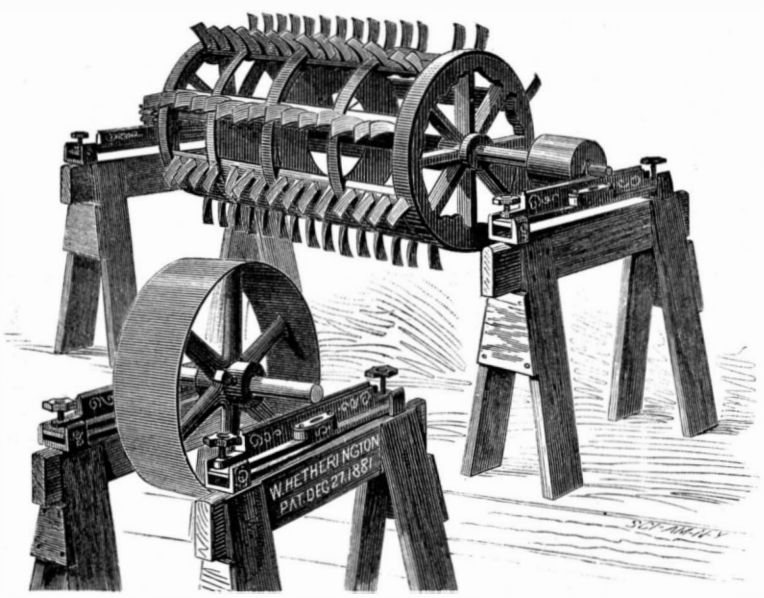
Prof. Osborn, of Miami University, Oxford, has discovered the beautiful amber colored mineral known to mineralogists as zinc blende or sulphide, in small quantities in the rocks at Niagara Falls. It may be found both above and below the inclined plane, but in the rocks which have recently been broken off, and sometimes in pieces several inches in length, especially in one immense block which has become detached from the American side, and lies near the water about 150 yards from the American Falls, in which one piece nearly five inches long was found. The specimens analyzed by Prof. Osborn all gave about 60 per cent zinc with traces of iron, but are only interesting as beautiful specimens of the mineral.

PARALLELS FOR BALANCING PULLEYS, ETC.

We give an engraving of improved parallels for balancing pulleys, thrasher cylinders, and other rotating parts of machinery. Usually the parallels are blocked up by wedges of wood, pieces of pasteboard, or anything else at hand, the level is applied, and the parallels are leveled approximately after the expenditure of much valuable time. The improvement shown in the cut has been patented by Mr. W. Hetherington, and is designed to facilitate the operation of leveling the parallels. Each bar is provided with a level and with a leveling screw at each end, so that the adjustment may be very quickly and accurately made.

These parallels are very desirable for machine shops, planing mills, etc., for balancing pulleys, saw arbors, planer heads, spindles, and all kinds of high speed machinery. They will also find extensive use among thrashers for balancing separator cylinders in the field, thus saving a trip to the machine shop.

Further information may be obtained by addressing Messrs. Hetherington and Lukenheimer, St. Cloud, Minn.



IMPROVED PARALLELS FOR BALANCING PULLEYS, ETC.

English Torpedo Experiments.

An interesting series of torpedo experiments, carried out conjointly between the 28th Company of Royal Engineer Submarine Miners, under the command of Capt. Bucknill, R.E., and Capt. Markham and the officers of the Vernon Torpedo School, lately took place in Portchester Lake, Portsmouth.

The experiments illustrated the operations of torpedo attack and defense, and were also intended to determine certain debatable points with respect to formulæ, the resistance of various breadths of water cushions, the lateral effects of different charges of gun cotton, etc. For these purposes War Office tubular dynamometers and crusher gauges were extensively used, the reading of which will form the subject of subsequent consideration.

The first experiment was the most exciting and important of the series. It was for the purpose of practically ascertaining the effect of a ground mine, consisting of 250 lb. of gun cotton, upon a steam launch, moored broadside on at a distance of 50 feet horizontally from it, the submersion of the charge being 30 feet. The launch, which was moored fore and aft, was in complete steaming trim, the pressure in the boilers being regulated at 40 lb. to the square inch. The mine was fired from the Nettle at the slack of high water. The detonation was loud and startling, but the practical results were disappointing. The whole energy of the explosion seemed to be in a vertical direction, the upward rush throwing up a splendid dome of water, and the downward blow producing a considerable up heaval of mud.

The lateral extension of the force was comparatively insignificant, for not only were the machinery and boiler of the launch uninjured, but it was scarcely shaken. In future experiments the attack will be made at gradually reduced distances, until the target is disabled. The use of hand charges of gun cotton was next exhibited. While a boat steamed rapidly through the water, a grenade containing 9 oz. of gun cotton was thrown into a cask and fired by means of an instantaneous fuse and a pistol. The cask was shattered into a thousand fragments, the result showing the fatal efficacy of the weapon when directed against open boats. A run was next made with a Whitehead torpedo discharged from an impulse tube above water. The projectile went straight to the target, after passing which it got its nozzle into shallow water and stuck. Various charges of gun cotton lashed to floating spars were afterward simultaneously fired at a uniform depth of 3 feet, for the purpose of testing the accuracy of Abbot's formulæ.

The method of countermining mined channels was shown by means of blowing charges, the whole single line being simultaneously exploded. Two outrigger charges of gun cotton, each 35½ lb., were also fired from a steam pinnace, which maneuvered in going ahead and turning, lowering its spars, reversing, and firing without a man being seen. The explosive force of the explosions was so violent that no ship could have withstood it. While this experiment was taking place, some practice with small guns was going on from the Excellent close at hand, and it was impossible to overlook the chances in favor of an outrigger attack.

The practice was made from a permanent, and consequently steady, platform, at targets at well known and unvarying ranges; and when it is considered that the targets were never once hit, the difficulty of staving off the attack of a rapidly moving torpedo craft will be easily recognized. The last experiment was made to test the effect of a boat mine upon a whale boat containing a dummy crew. The mine consisted of 12 lb. of gun cotton confined in a circuit closer jacket, sunk 2 feet under the water and at the same distance from the target. When fired, the whale boat rose piecemeal into the air, and descended in a rain of fragments.—*London Times.*

Canine Intelligence.

A remarkable instance of the fidelity and sagacity of the dog lately happened at Milford Haven. Two men named Davies and Taylor were out in a boat, which was swamped. The former of these was the owner of a dog, and while the men were struggling in the water the animal caught hold of Taylor with the object of supporting him; finding, however, that it was not his master to whom he was rendering this assistance, he relinquished his grasp and went to the aid of Davies, his master, supporting him until he was rescued by a passing steamer, the other man being drowned.

There are fifty-six shops for the sale of horse-flesh as food in Paris.

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Brass and Its Uses.

It is an interesting fact that all the principal metals, with their amalgamations and alloys, have certain distinct and exclusive uses to which they are adapted, and for which no other metal can be substituted with as good results. The fact that for many uses one metal may be substituted for another to advantage does not change the other fact that there are certain adaptations and a certain fitness of things which give exclusive value to certain metals for certain uses. Thus, no matter how golden the age in which we live, the use of gold for fireplace fenders would be out of place, and not alone on account of its costliness. So the use of brass for personal ornament is equally unfitting.

Brass is mentioned in the earliest writings, although in many instances the word bronze would more correctly represent the character of the metal spoken of. Among the ancients, those who could not ornament with pure, solid gold seized that which looked the most like it, and answered, practically, the same purposes. Brass as an alloy will bear a variety of metals. Corinthian brass of the ancients combined, in its make, a proportion of gold and silver, as well as copper, tin, and other metals. Metallurgy is now so well understood that copper, zinc, tin, magnesia, sal ammonia, crude tartar, and other chemicals, in the hands of practical artisans, may be so combined that a metal can be made which will not only look like gold, but take a finer finish and remain longer bright, whether in use or in a state of rest, than the purest gold of California! For this higher grade of brass there is an increasing demand for many purposes. First-class banking houses become resplendent when finished up with choice rolled, perforated, polished, and otherwise ornamented brass, according to the position it is to occupy in forming divisions of the departments. Such brass shields may be so finely finished that for months, with a very little daily care, they will remain as bright and beautiful as a newly coined double eagle. For these good reasons perforated plate brass is in demand for not only bank work, but in first-class offices of all kinds.

Then, however comfortable our best automatic furnaces, or soft and diffusive the warmth of our extra plated and ornamented base heaters, gentlemen who are finishing up fine dwellings for their own use, in which they expect to spend the greatest proportion of their remaining days, like to retain the good old style of both their European and American ancestors, who sat before an open log fire or an open grate of coals! These, in every double parlor, under ample mantels, require not only grates of the most improved kind, but a variety of furniture, the ornamentation of which draws largely on the brass founder and his most skillful and ingenious workers. These very beautiful brass-decorated open grates have proved to be extremely attractive to young children, and genius of a high order has been in demand to concentrate its best powers to furnish such a "fender" as shall prove a guard, not only for the uncertain steps of childhood, but for the influence which a strong current of air has over the apron and pinafore; for these articles also need a barrier to the attractive draught of a glowing fire of coals. These brass fenders admit of very great elaboration. While very beautiful as shields, they must neither hide the glowing coals nor obstruct their light or warmth. For these adjuncts of the open grate no metal has yet been discovered so good as brass, for while it reflects much warmth, it is not injuriously affected, either in texture or polish, by an ordinary grate fire of coals. It is, therefore, an admirable metal for all stove and grate furniture or ornaments. Fenders, fire-irons, etc., in polished brass, with coal vases, fire-brasses, and dogs *en suite*, are in demand on both sides of the sea. A staple trade is done in polished all-brass fenders and curbs, composed of reeded rails and spindles, alternating with *repousse* or cast panels. A brass embossed Japanese fender in panels with bright steel bottom gives a pleasing effect. Pretty designs in Berlin black, relieved by buffing, supply cheaper goods. An effective fire-dog is a T-shaped tubular rest, with reeded base and knobs, and connecting scrolls in the Renaissance style. Another popular design is of tubular brass with cast supports in the Renaissance style, relieved by portions in gilding metal.

Among late and most beautiful tea and coffee urns may be seen those of brass. Mounted on a base or stand of the same metal, they are suspended on trunnions—similar to the latest style of ice pitchers—or hinged to their base they tip easily, and pour their contents with scarcely a perceptible effort on the part of the waiter. These goods are both exceedingly attractive and useful.

There is, also, a richness and beauty about a fine harness all of whose hardware is brass, that cannot be gained by any other combination. The pure polished black and yellow give the finest "jet and gold" that can readily be obtained.

The tendency in carriage, railway coach, and, indeed, in house furniture generally, is in the same direction. Butts, hinges, door knobs for passenger cars, have for some time been of bronze, as have been the hand-bag racks in the finest passenger car coaches, but fine brass wire or perforated rolls are now preferred on account of superior brightness and beauty. And for draw knobs brass "half shell" handles are—by all who use draws—greatly preferred, both for beauty and convenience.

These are but a few of the tendencies of the times which indicate a wiser and more extensive use of fine brass than heretofore. Time and space would fail to give merely a synopsis of its uses in the arts; its necessity to the machinist, especially machinery of the finest kinds, clocks, watches, chronometers, and philosophical instruments of all kinds; its adaptableness for lamps, chandeliers, gas-fittings, meters, and all kinds of scales. In proportion, therefore, as a people advance toward the highest kind of knowledge—that of best adapting means to ends—will there be an increasing demand for brass in machinery, in scientific instruments, and in all efforts to give permanent ornamentation which shall be excelled only by pure gold.—*Amer. Artisan.*

Origin and Development of Steam Navigation.

Rear Admiral George Henry Preble, of the retired list of the United States Navy, and one of its oldest officers, has written an interesting volume entitled "A Chronological History of the Origin and Development of Steam Navigation."

The work begins with the first practical use of steam as a motive power for vessels by Blasco de Garray, at Barcelona, Spain, June 17, 1543, and shows the advancement of steam navigation to the present time. The proposition of De Garray in 1543 appeared ridiculous, but he was so convinced of its ultimate success that he influenced the Emperor Charles V. to appoint a commission to witness his experiments. They were, in a degree, successful, and De Garray was promoted to the rank of an officer and rewarded with a considerable sum from the treasury.

In 1630 Charles I. of England granted a patent to David Ramseye, "to make boats, shipes, and barges to go against strong wind and tide." While Denis Papin, a French engineer, is claimed to have been the inventor of the steam engine in 1690, Jonathan Hulls, who in 1736 obtained a patent for propelling a boat by steam, which, however, was never put to practical experiment, was no doubt the first Englishman who proposed to apply that power to naval purposes. James Watt, who did more to make navigation by steam a practical success than any inventor who preceded him, obtained his first patent for a steam engine in 1769. The general idea of propelling vessels by a submerged helix or screw is ancient, and its modern application to vessels propelled by steam power, Admiral Preble shows, is not due to any one man.

A vessel built by Capt. Ericsson was probably the first practical screw propeller the world ever saw. The successful application of steam to the purposes of ocean navigation has brought with it an era of rapid improvement in naval architecture and all other matters relating to nautical affairs.

In the year 1810 arrangements were made with Robert Fulton to construct a steam ferry boat, and on July 2, 1812, one named the Jersey began running between Paulus Hook, Jersey City, and New York. The event was celebrated with a grand banquet given by Jerseymen to the New York Common Council. The boat was supposed to make half hourly trips, but frequently an hour was consumed in making the passage. Near the close of 1814 Fulton exhibited to the President of the United States the drawing of a proposed war steamer or floating battery. The project was favorably received, and on June 20, 1814, the keel of Demologos or Fulton the First was laid at Brown's shipyard in New York. She was launched on October 29, 1814. After the war she was used as a receiving ship at the Brooklyn Navy Yard until June 4, 1829, when she was accidentally or purposely blown up.

Coming down to the construction of the American steamship Savannah, the first ocean vessel propelled by steam, and which made the passage from New York to Liverpool in twenty-six days in 1819, the author declares that Mr. Woodcroft was grossly in error when he pronounced her, in his work on "Steam Navigation," a myth. She was built at Corlaers Hook, New York, and was of 318 tons burden. The first steamboats to ascend the Missouri, Admiral Preble says, were three little Government boats, in 1819, one of which carried the figurehead of a serpent at her prow, and through the reptile's mouth the steam was discharged. When the savages saw this they fled in alarm, fancying the spirit of evil was coming bodily to devour them. In the same year the first steam vessel, the Robert Fulton, was put on the route between New York, Charleston, Havana, and New Orleans. She was afterward sold to the Brazilian Government, and was running as late as 1838. On July 12, 1822, the Rhode Island and New York Steamboat Company was formed, and this was the beginning of the Long Island Sound traffic.

The first iron clad battery was conceived by Robert L. Stevens, of Hoboken, in 1832. It was to be an iron armed ship, 250 feet in length. The keel was laid at the foot of Fourth Street, Hoboken, in 1843. At odd periods new improvements were designed, and upon his death Mr. E. A. Stevens left $1,000,000 to complete the vessel, directing that it should then be given to the State of New Jersey. The million was expended, suits were brought by the heirs, and at last, in 1860, the unfinished war vessel was sold as old material to W. E. Laimbeer for $55,000. Admiral Preble accords to John Ericsson the credit of inventing the first practical screw steamer in 1836, and the famous Monitor. Capt. Ericsson also had the honor of designing the Princetown, the first screw war vessel ever constructed, although Fulton the Second was the pioneer steam war vessel of our present naval organization, and the second war vessel built by the United States.

Experience having shown that a sea steamer of 1,800 tons, making the quickest passages to and from England and Australia, with a full cargo and complement of passengers, lost by the voyage from £1,000 to £10,000, did not deter the Eastern Steam Navigation Company, with a capital of £1,200,000, from building the Great Eastern, a vessel quite overshadowing Noah's Ark. The Great Eastern was 680 feet in length, 83 feet beam, 58 feet depth of hold, and 28,093 tons measurement. Noah's Ark was 547 feet in length, 91 feet beam, 54 feet depth of hold, and 21,762 tons measurement. The Great Eastern was eleven days making the trip to New York.—*Elevated Railway Journal.*

The Salmon Disease.

An interesting lecture was recently delivered by Professor Huxley at the Fisheries Exhibition Congress, upon the disease which makes such ravages among fresh water fish, particularly the salmon, and sometimes in the form of an epidemic. This disease, which is marked by the appearance of whitish patches on the skin of the fish, is attended with great mortality. In the last five years from 2,000 to 4,000 diseased fish have been taken out of the Tweed, and a like number from the Eden every year. Last year as many as 600 diseased salmon were taken out of a small river like the Leme. On the east coast a few cases have appeared in the Coquet, but none in the Wear. On the Tyne the disease is almost unknown among clean salmon, but it is common with kelts and dace. It may be said that there has been practically no epidemic outbreak in the eastern rivers south of the Tweed. The eccentric course of the epidemic, however, is shown in the fact that on the west coast the state of affairs is totally different, it having made its appearance more and more to the south, until last season it broke out in the Usk and Wye.

The disease is due to the fungus *Saprolegnia ferax*, which abounds in Irish waters, living on decaying organic matter, but having also the property of attacking living organic matter, so that the wonder is that salmon are not always diseased. Professor Huxley pointed out that it was desirable to ascertain the nature of the influences whereby the widespread sporadic disease suddenly assumes an epidemic character. On this point we have very little light at present, for although there is considerable reason for thinking that deficient oxygenation, whether produced by overcrowding or otherwise, may favor the production of the disease, and though it is probable that some kinds of pollutions may favor it, yet the disease sometimes becomes epidemic under conditions in which these two predisposing causes are excluded. The productiveness of a salmon river is not necessarily interfered with by even a severe epidemic, and therefore Professor Huxley's opinion was that on the whole it were better not to attempt to extirpate the diseased fish.

A Balloon Crosses the Channel.

A correspondent of the London *Times* says that two aeronauts, one a Belgian, named Morum, and the other a Frenchman, named Da Costa, without intending it, had succeeded in accomplishing what several balloonists have recently attempted in vain, viz., crossing the Channel. It appears that the aeronauts ascended at Courtrai, in Belgium, on Tuesday evening, with the intention of proceeding in an easterly direction and descending somewhere near Liege or Cologne. When over Louvain, however, they encountered an easterly current which took them over Ostend, and, to their alarm, they were carried out to sea. It appeared as if they would cross the Channel successfully, but suddenly from some unaccountable reason they began to descend. The aeronauts endeavored for some time in vain to check the descent of the balloon, so their position became an exceedingly perilous one. But by throwing overboard large quantities of ballast they again managed to ascend, and before long passed over Dover, when the balloon began to descend again, and next morning alighted in a field near Bromley. The aeronauts were treated with great hospitality, and, having allowed the gas to escape from their balloon, sent it on to London.

Photographic Positives Produced Directly on Paper.

Cros. Vergeraud has utilized the properties of bichromates to produce positives directly on paper. He first saturates a suitable kind of paper with a solution of 2 parts of bichromate of ammonia and 15 of glucose in 100 parts of water, dries it, and exposes it under any positive (either a glass transparency, a drawing, tracing, or other flat object). As soon as the exposed parts turn gray it is immersed in a bath consisting of one part of nitrate of silver and 10 of acetic acid in 100 parts of water. The picture makes its appearance at once and is of a blood red color (bichromate of silver).

Wherever the light acts upon it the glucose reduces the bichromate, but in those places which have been protected by the drawing, etc., the bichromate will be unchanged and hence capable of forming chromate of silver, which is insoluble in water. If dried by the fire the picture will remain red, but if exposed to the sunlight it becomes dark brown. Sulphureted hydrogen or a bath of potash and copper turns it black.—*Comptes Rendus.*

Decrease of Immigration.

The report of the Chief of the Bureau of Immigration to July 1, 1883, shows that while for the fiscal year ending June 30, 1882, the number of immigrants into the country, by seacoast and Canada, was 770,422, for the year ending June 30, 1883, the number was only 592,324. And for June, 1882, 84,786 immigrants landed; while for June, 1883, only 75,034 came into the country.

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Centrifugal Strain in Revolving Cylinders.

BY S. WHIPPLE.

By the law governing central forces, all parts of a cylinder revolving about its axis exert a centrifugal energy as (proportional to) the weight and square of velocity *directly* and *inversely* as the radius of orbit.

Let R represent the radius, and L the length in feet of a revolving cylinder, and r the radius and v the velocity of revolution, and w the weight of a part at any distance from the axis within the periphery.

And let the cylinder be regarded as constituted of an indefinite number of very thin concentric circular bands or laminæ of uniform density and thickness. Then, the centrifugal tendency (cf) of each band will be as

$$\frac{v^2 w}{r},$$

or simply as r^2, since v and w are obviously each as the radius r. Whence it appears that the cf of the respective bands increases outwardly from the axis as the squares of respective radii; that is, in the same proportion as the sections of a pyramid parallel with the base increase from apex to base. And as the bulk of a pyramid equals the base into $\frac{1}{3}$ the altitude, so the aggregate cf of all the bands constituting the cylinder equals the cf of the outside band into $\frac{1}{3}$ the number of bands, or, obviously, equals what would result from a mass of the material represented by the area of the outer band multiplied by $\frac{1}{3}R$; or, a mass equal to $\frac{2}{3}$ the bulk of the cylinder, concentrated in the outer band.

Now, every mathematician or dynamical expert may be presumed to know that the force by which each half of a revolving cylinder tends to pull itself directly from the opposite half has the same ratio to the radial cf of material in the half cylinder that the diameter has to the semi-circumference; and as such radial force has been shown to be equal to that of a mass represented by the area of the half outer band into $\frac{1}{3}R$, the force tending to separate the halves, is equal to the radial cf of a mass represented by the diametrical section into $\frac{1}{3}R$; that is, equal to $2RL \times \frac{1}{3}R = \frac{2}{3}LR^2$, revolving in an orbit whose radius equals R.

Now the weight of this mass ($\frac{2}{3}LR^2$) equals $\frac{2}{3}LR^2G \times 62{\cdot}5$ lb. (G denoting specific gravity of material, and 62·5 lb. the weight of a cubic foot of the unit material for specific gravity), and substituting this expression for W in the familiar symbol for centrifugal force,

$$\frac{V^2 W}{gR}$$

(in which V = vel. in feet per second, W = weight of revolving body, R = rad. of orbit, and g = vel. due to the action of gravity during one second), we obtain the amount of strain upon an area of section equal to that made by a plane bisecting the cylinder and coinciding with the axis; that is, $= 2RL$.

Hence the equation:

$$\frac{V^2 \times \frac{2}{3}LR^2G \times 62{\cdot}5}{gR} =$$

strain upon an area equal to the bisecting section $2RL$.

Then, dividing by this section, we obtain

$$\frac{V^2 \times \frac{2}{3}LR^2G \times 62{\cdot}5}{2gR^2L} =$$

strain per square foot.

Whence, canceling $2R^2L$, transferring below the line the denominator 3 (of the $\frac{2}{3}$), substituting value of g ($32\frac{1}{6}$ feet), and dividing by 62·5, we have:

$$\frac{V^2G}{3 \times 32\frac{1}{6} \times 62{\cdot}5} = \frac{V^2G}{1{\cdot}544} =$$

strain per square foot; which divided by 144 gives:

$$\frac{V^2G}{222{\cdot}336} =$$

strain per square inch, $= S$. Whence

$$V = \sqrt{\frac{222{\cdot}336S}{G}} =$$

peripheral velocity required to produce a given strain equal S per square inch.

In the case of a grindstone or emery wheel with a hole in the center, the strain given by the formula is increased in the ratio of the reduction of section available for cohesion.

Cost of Live Beef and Dressed Beef.

The increase in the traffic in dressed beef between Chicago and the East has alarmed those dealers who are interested in the transportation of beef on the hoof, as, if the dressed beef business grows unchecked, the expensive rolling stock and yard equipment of the Chicago live beef shippers will become valueless. The Chicago *Railway Review* says:

"Every effort has been made therefore to crush out the dressed meat trade, and this it is hoped can be accomplished through an increase of rates on such business. It already pays a much larger rate than does live stock, the charge for the latter being 40 cents per hundred pounds, and for dressed meats 64 cents per hundred pounds."

An investigation has been made into the relative cost of the two conditions of beef while in transit. From the report of this investigation it appears that the cost of live beef shipment per 100 pounds in addition to transportation is 17¾ cents. The cost of dressed beef shipment per 100 pounds is 24 cents, exclusive of transportation charges. The summary of the report is contained in the following:

"The present rate for transporting live stock to New York is 40 cents per 100 pounds. The estimated cost in addition to transportation charges is 17¾ cents; the total cost per 100 pounds, including railroad charges, is 57¾ cents. It requires 175 pounds of live steer to make in Chicago 100 pounds of dressed beef; hence the cost of the dressed beef per 100 pounds, when obtained from live stock in the East, is $1.01. The extra cost of shipping dressed beef has been estimated at 24 cents. The railroad transportation charge should therefore be 77 cents in order to make the total cost of transporting 100 pounds of dressed beef from Chicago to New York the same as the cost of transportation of 100 pounds of dressed beef when the steer is slaughtered in New York and the rate of railroad transportation is 40 cents per 100 pounds."

The animus of the movement for "crushing out" the dressed beef business is sufficiently shown by the quotation from the *Railway Review* given above, and the immediate object is "to make the cost of transportation on 100 pounds of dressed beef the same, whether the steer is slaughtered in Chicago or in the East."

It thus appears that consumers of beef in New York city and the East generally (largely the poor working people) are taxed on its original price to add to the profits of the railway companies and the dealers in live weight beef in Chicago.

But there are other considerations besides that of penny-wise economy in the two methods of transportation. A writer in the *Railway Review* alludes to a not uncommon sight in the following words:

"The present fashion of transporting live stock is barbarous in the extreme, and if the cruelties perpetrated upon dumb beasts which are to be used as food were known, public sentiment would suppress the whole business in short order. The writer recently saw a live stock train upon one of the trunk lines which made him heart-sick. The cattle were crowded into a car as closely together as they could stand; it was a hot day; all the animals were gasping for breath; some, exhausted, had fallen and were lying upon the filthy floor under their fellows. Whenever the train started it jerked them back, and when it stopped it threw them forward. In this way they were to be carried a thousand miles, and when they arrived, bruised, sick, and fevered, at their journey's end, the survivors were to be butchered to furnish meat for human beings."

On the contrary, the dressed beef sent from Chicago is from animals slaughtered after a rest in commodious stock yards; the meat is cooled in refrigerating rooms, and it is then hung in quarters in a refrigerator car, the ice of which is renewed when necessary *in transitu*. Taste, as well as humanity, would surely prefer the dressed beef method.

Standards for Freight Car Building.

The apparent benefit of some standards in the building of freight cars is so obvious that it is no wonder that railroad men have directed their attention largely to it within a few years.

The *National Car Builder* says that it is clear that nothing in the construction of freight cars can be fixed and unvarying so long as there is no absolute limit to the maximum weight of loads they are to carry. As the freight traffic of the roads is now managed, the maximum car load is the basis which necessarily regulates the construction. It is no exaggeration to say that within the past ten years freight car loads have been increased 15 tons, and this increase is likely to be doubled in the next ten years. If a limit could be fixed for the load, whether 30, or 40, or even 50 tons, there would be a basis upon which to work, although it might necessitate radical changes in the present structure of cars from wheels to roof. But unfortunately there is no restriction upon overloading, and things must take their course. The most important members of the structure are the wheels. Instead of uniformity in their manufacture, the diversities and irregularities are almost endless. There is trouble with the form of flange, width of tread and width of wheel, they are not round nor balanced, there is no standard gauge, the hub bore is not concentric with the circumference, there is no uniform point on the treads for measuring, and the utility of coning the treads is involved in great uncertainty. If the wheels are imperfect, the rest of the structure will share the imperfection. Those who are inclined to be sanguine that the millennium of standards and interchangeableness is about to dawn, should bear in mind that so long as every road is free to adopt and use what it pleases, it will be impossible to enforce the use of standards that put a veto on all subsequent improvements, and stop the process of development by saying, "Thus far and no farther."

It would seem, however, from some facts apparent at the recent railway exposition at Chicago, that the limit of load had been reached, or at least the limit of the relation of the load to the weight of the car; and to an outsider it would seem that some agreement of at least these important particulars might be reached by railroad men. The Chicago *Grocer* says that "ten years ago the maximum capacity of a freight car on most roads was 20,000 pounds, with a weight equal to or exceeding this amount. For every ton of paying freight hauled there was another ton of dead weight. Latterly the railroad companies have been increasing the carrying capacity of the car without materially adding to its weight. Thus the 40,000 pound car weighs on an average about 23,000 pounds, giving nearly two tons of paying freight to every ton of dead weight. These cars are now in general use on all the roads, the smaller cars being replaced by them as they wear out. But among the freight cars on exhibition, we noticed some of still greater carrying capacity. Thus a 50,000 pound car weighed only 24,900 pounds; a 60,000 pound coal car weighed but 22,750 pounds, and a 70,000 pound freight car weighed 32,300 pounds. This latter was a three truck car, there being a truck under the center as well as at each end. Some of these cars are doing regular service on the Missouri Pacific road, enabling the company, as we were informed by the person in charge, to do 30 per cent more business than with the cars of ordinary capacity."

Tests of Coals.

In making a series of experiments to determine the relative value of different coals as fuel for the army, Quartermaster-General Meigs tested thirty-one specimens, with the result of ascertaining that two submitted specimens of semi-bituminous coal showed a higher evaporative power than the submitted specimens of anthracite or bituminous coals. The following table gives the best results obtained by Gen. Meigs from coals of the different classes, showing the pounds of water evaporated, at 212°, per pound of coal.

Semi-bituminous coal, from Somerset County, Pa.	9·85
" " " " "	9·75
Anthracite from Schuylkill County, Pa	9·37
" " Luzerne " "	9·28
" " Dauphin " "	9·07
" " New Mexico	9·04
Bituminous from Pittsburg, Pa.	8·78
" " New Mexico	8·60
" " Glasgow, Scotland	7·61
" " Newcastle-on-Tyne, Eng.	7·52
" " Weber coal, Utah	4·73
" " Lignite, Dakota	4·03

These tests must not be considered as generally determinate in regard to the highest value of different kinds of coal; for other well known authorities have accorded to anthracite the evaporative power of 9·50 pounds of water to one pound of coal, and for bituminous coal 8·75 pounds of water to one of coal. The tests made by General Meigs are only valuable as showing the comparative usefulness of the particular specimens subjected to his experiments.

Common Sense in Summer.

The employment of the natural common sense possessed by intelligent adult humanity would do much to mitigate the discomforts of our torrid summers. Natural appetite, if not corrupted or perverted, is an excellent guide to eating and drinking. The following of Procrustean rules as to the quality and quantity of food is pernicious. An unvarying amount of food, as three hearty meals each day, which might be healthful for winter or the cool weather of autumn, is not appropriate for the intense heats of summer. No set of rules can be laid down for anybody's guidance, still less is it competent to make rules for everybody's guidance; but a few simple suggestions made by a physician recently may not be amiss.

He said: "Keep cool in temper; enter into no argument or contention on politics, ethics, or religion; restrain anger; attempt no athletic feats of rowing, walking, or ball playing; look on the pleasant side of your circumstances; be kindly affectioned, as St. Paul recommended; do not sit out doors long after sundown—the less of this the better; never work before breakfast; eschew meats as much as possible and chew food thoroughly; drink but little ice water or hot tea and coffee—warm tea is not injurious. Lemonade in moderate quantities is not hurtful. Alcoholic stimulants should be tabooed entirely unless a physician's prescription compel their use. Do not allow your dress to be a burden in material or amount, nor have it so light and thin that the body, from perspiration, becomes chilled."

How to Remove a Tight Ring.

A novel method of effecting the removal of a ring which has become constricted around a swollen finger, or in any other similar situation, consists simply in enveloping the afflicted member, after the manner of a circular bandage, in a length of flat India rubber braid, such as ladies make use of to keep their hats on the top of their heads. This should be accurately applied—beginning, *not* close to the ring, but at the tip of the finger, and leaving no intervals between the successive turns, so as to exert its elastic force gradually and gently upon the tissues underneath. When the binding is completed, the hand should be held aloft in a vertical position, and in a few minutes the swelling will be perceptibly diminished. The braid is then taken off and immediately reapplied in the same manner, when, after another five minutes, the finger, if again rapidly uncovered, will be small enough for the ring to be removed with ease.—*Langon, Gaz. des Hop.*

Cleanliness of Sinks.

One of the most prolific causes of defilement and offensive odors in kitchen sinks and their outlets is the presence of decaying grease. This comes from the emptyings of kettles in which meat has been cooked, in the dish water, and in the soap. The grease lodges in every crevice and catches at every obstruction. A remedy may be found in the use of the common alkalies instead of soap, aqua ammonia in washing clothes, and borax in washing lawns and laces, and washing soda in cleaning dishes. These alkalies prevent a solid soap from forming in the sink and its pipes and neutralize all effects of decomposing fat.

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Waterproof and Fireproof Fabrics.

The *Textile Record*, which ought to be good authority on such subjects, says that the tungstate of soda is about the most serviceable substance for making fabrics fireproof. For use it is dissolved in five times its weight of lukewarm water. The solution is then mixed with a very small portion of phosphate of soda, and it is then ready to be used for saturating tissues. After being well steeped the goods are wrung out and dried at a gentle heat, and may then be ironed, etc., as usual. They will be found capable of resisting the action of the heat for a long time, and if ignited they merely smoulder without bursting into flame. For making fabrics waterproof, the following process, the editor of the same journal says, is highly recommended, but he has never observed its practical results: A composition is prepared with nitrate of potassium (saltpeter), 200 pounds; resin, 270 pounds; gum, 30 pounds; slaked lime, about 100 pounds.

"A milk of lime is first prepared, then the saltpeter is dissolved in water, and heated in a boiler, then so much lime is added that it does not become pasty, when the two other substances which have been fused on a slow fire are added. This composition can be left to cool, and being unalterable can be kept for use. To render tissue waterproof 100 pounds of this mixture are dissolved with one gallon of boiling water, while on the other hand 10 pounds of alum are dissolved in 10 gallons of water. The fabric is first passed into the first solution, and then into the second, and finally dried between cylinders."

Honors to an American Engineer.

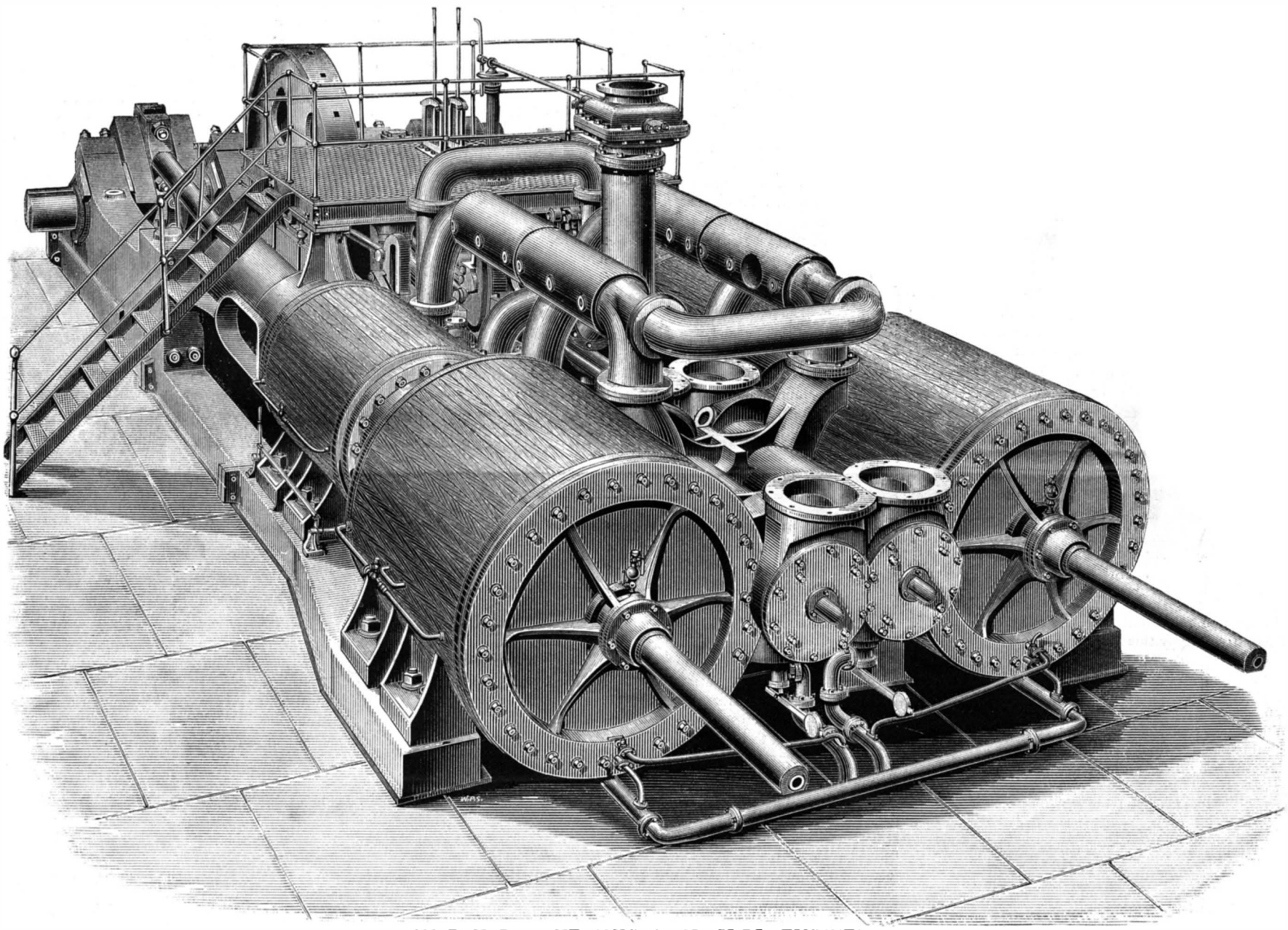
The Academie des Sciences, Belles-Lettres et Arts de Lyons, France, at its annual meeting on July 10, awarded the gold medal (founded by Prince Lebrun for the encouragement of useful inventions) to Mr. Ed. W. Serrell, Jr., of New York, for an automatic reel for silk. In a letter from Mr. Peixotto, published in the SCIENTIFIC AMERICAN, issue of June 10, 1882, on the silk industry of France, allusion is made to Mr. Serrell's invention. The writer at that time said he had great hopes that Mr. Serrell's automatic reel would prove successful, and that the invention was creating a great deal of interest among the silk growers and silk manufacturers in the south of France.

This discovery, according to experts, says the *Continental Gazette*, Paris, is destined to work the same revolution in the silk world as was wrought ninety years ago by the invention of the cotton gin. Cotton before then went to waste on the fields, and by the proletarian labor of Europe, and particularly of the Orient, the reeling of silk from the cocoon is until now an impossibility in the United States, and is rapidly becoming so in Europe, owing to the increased and increasing cost of labor. In according the prize to Mr. Serrell, the President of the Society, M. Rougier, one of the most eminent of French barristers, paid a high compliment to the genius and perseverance of the countryman of Benjamin Franklin. He said that France, in her appreciation of genius, knew no country or nationality. She resembled in this respect the great Republic of Washington, and she was ever happy to render to genius her merit, for science and art were universal.

IMPROVED REVERSING RAIL MILL ENGINES.

The engravings on this and another page illustrate by two perspective views a large pair of horizontal compound reversing rail mill engines, made by Messrs. Tannett, Walker & Co., of Leeds, for the works of MM. De Wendel et Cie, Hayange, Lorraine, and Joeuf, France.

The engines in question have two high pressure cylinders, each 34 inches in diameter, and two low pressure cylinders, each 60 inches in diameter, all having 5 feet stroke. The cylinders are steam jacketed, and provided with piston valves and link motions, the latter being worked by a hydraulic cylinder for reversing. The crank shaft, which is of the marine type, is made in two pieces bolted together, and weighs about 13 tons. The pins are 18 inches in diameter and 15 inches long, and there are four bearings, each 18 inches in diameter and 22 inches long. The connecting rods are 13 feet 6 inches centers. The engines are constructed to work at a pressure of 90 pounds to 100 pounds per square inch, and deliver their exhaust steam to a surface condenser, fitted with brass tubes three-fourths of an inch in internal diameter. This condenser also serves to condense the steam of the accessory engines, always to be found in a rail making plant, and is provided with an independent pair of horizontal engines, with cylinders 16 inches in diameter by 30 inches stroke, which work two double acting circulating pumps. We are indebted to *Engineering* for the illustrations and particulars.



IMPROVED REVERSING RAIL MILL ENGINES.

Engineer and Fireman Both Asleep.

The occurrence on the Holyhead line of the driver and stoker of a train falling asleep while on duty and the extraordinary escape of the Irish mail last week was even more serious than reported. It would appear from inquiries made on Monday at Llandudno Junction by our correspondent that the signalman there, by extraordinary presence of mind, saved the Irish mail passengers on Tuesday night from what might have proved a terrible fate. The signalman at the junction received a message from the signalman at Conway, the next station toward Holyhead, that a light engine was coming. The junction signalman, knowing that the Irish mail was due, decided to run the engine into a siding in order to permit the express to pass. He accordingly put up all the signals against the light engine, but to his extreme astonishment the engine came straight into the junction at full speed, swept round the corner, dashing past all the danger signals, and disappeared from view down the line toward Chester. A moment's reflection convinced the signalman that both driver and stoker must be asleep. He accordingly wired to the Colwyn Bay Station signalman, "Engine coming; driver asleep; put fog signals on line." The man at Colwyn Bay was equally prompt, for, running out of his box, he had hardly time to lay a number when the engine came thundering along and an explosion followed, which effectually awoke the men. The engine was stopped and run back into a siding, when it was discovered that the fire had gone out, the water had disappeared from the boiler, and that the men had been asleep some time. Inquiry has resulted in their immediate discharge. They had been fifteen hours on duty.—*London Times.*

Waterproof and Other Special Paints and Varnishes.

The *Neueste Erfindungen* says that the waterproof preparation of G. Gehring, in Landshut, is prepared by melting together 60 parts of paraffine, 15 parts of wax, and 30 parts of palmitate of alumina made by precipitating a solution of palm oil soap with alum. The stone, metal, or wood that is to be waterproofed is warmed to 140° or 200° Fah., and then coated with the melted mixture. For fabrics he employs a mixture of 60 parts of paraffine, 20 parts of palmitate of aluminum, and 10 to 15 parts of yellow wax dissolved in linseed varnish, to which is added from 6 to 15 parts of oil of turpentine.

A. Riegelmann, in Hanau, has patented a rust protector which consists of ordinary oil paint mixed with 10 per cent of burned magnesia, baryta, or strontia, as well as mineral oil. This neutralizes the free acid of the paint, and the alkaline reaction protects the iron from rust.

To prevent iron from rusting in the ground it is painted over with a mixture of 100 parts of resin, 25 parts of guttapercha, 50 parts of paraffine, and 20 parts of magnesia, besides mineral oil. A temporary paint for the movable parts of machinery contains 20 or 30 per cent of magnesia or burnt dolomite, with some vaseline added to prevent drying.

THE Suez Canal Company intend adopting the Pintsch system for lighting the entrance to the canal; and with this view have ordered eight 9-foot spherical gas buoys, each to burn for two months, three fixed lights to burn two months, and three large holders for storing gas and filling the buoys, together with a small gas works to be erected at Port Said. It is proposed to extend the system to other parts of the canal.

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THE TURBOT, GOLDBUTT, AND SOLE.

The scientific name of the flat fishes, as they are popularly called, is *Pleuronectidæ*, signifying "side swimmers." The upper side of these fishes is always dark, and the under side white; this guards them against the attacks of their enemies, the dark flat surface looking like the sand on which they love to creep. When swimming, they undulate through the water in a very graceful manner. "If the eyes were placed as is customary in fishes, one of them would be useless as long as the fish was lying on its side. By a modification of the bones of the head both of the eyes are brought to that side which remains uppermost, and they are thereby enabled to command a wide view around."

The turbot (*Pleuronectes maximus*) is the most highly valued of the flat fishes for the delicacy of its flesh. Its color on the left side is brown of various shades, lighter on the fins, and the whole of this side is spotted with round bony tubercles; the other side is white. The length of this fish is more than a meter; the weight, about thirty-five kilogrammes. Rondelet asserts that he has seen a turbot three meters long, two broad, and almost a meter thick. It is found in the German Ocean and the Baltic Sea, also in the Mediterranean. It is caught in the greatest abundance in the German Ocean.

Under the name *Platessa* may be found the species of fish with four-cornered or egg-shaped bodies. The eyes and the color, as a rule, are upon the right side, but reversed specimens are quite common.

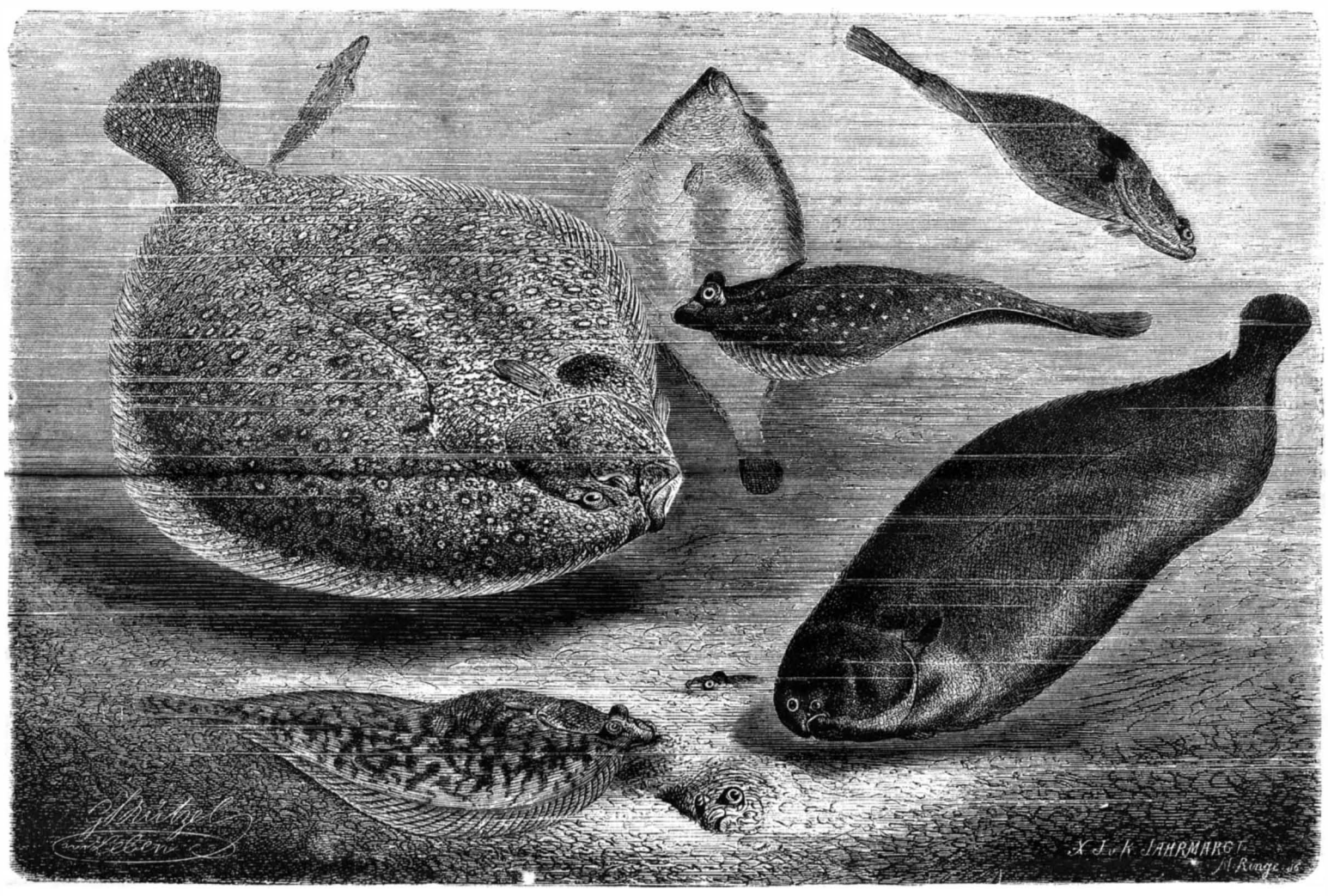
The goldbutt belongs to this family. Its length seldom exceeds sixty centimeters, its weight only exceptionally seven kilogrammes. It is variously colored, but generally the upper side is brown marbled with gray and marked with round yellow spots. The other side is yellowish-white. It is found almost everywhere in the Atlantic Ocean, the Mediterranean and Baltic Seas, and in great numbers in the German Ocean.

The sole (*Solea vulgaris*) is about sixty centimeters long, and weighs about four kilogrammes. Upon the upper side and upon the pectoral fins it is black, and on the other side brownish. It is found all along the coast of Western Europe, and is also abundant in the German Ocean.

Nearly all of the flat fishes are found in shallow, sandy places near the coast; but they sometimes retire into the deep water. The flesh of all the flat fishes is palatable, and that of many of them is of superior excellence. They form a very important article of food. On most of the sea coast they are only eaten when freshly caught, but in the North they are cut in strips and salted and dried in the air, as the codfish, or smoked. The goldbutt and turbot are specially valued. Great numbers of these fish are sent to the London market by the people of Holland.

The capture of the flat fish is carried on in various ways, according to the locality and their abundance. Sometimes the fishermen at the ebb of the tide wade into the muddy sand, hold the fish down with their feet, and then pick them up. In some places on the coast a great many may be caught in this way, but they are taken chiefly with a drag-net.

Many of the flat fish may be acclimated to live in fresh water. They may be kept in narrow quarters, and soon become accustomed to the vessels in which they are kept, learn to know those who care for them and their feeding time, and will often take their food from the hand. The turbot feeds upon mollusks and crustaceans, besides fish. — *From Brehm's Animal Life*



THE TURBOT, GOLDBUTT, AND SOLE.

NATURAL HISTORY NOTES.

The Flowering Plants of the World.—"The Genera Plantarum" of Bentham and Hooker, just completed, gives a rough approximation of the number of plants that compose the present phanerogamic flora of the world, according to the authors' own ideas, and according to the ideas of the writers. From this it appears that the polypetalæ comprise 30,966 species; the gamopetalæ, 34,567; the monochlamydeæ, 11,778; the gymnospermeæ, 415; and the monocotyledones, 17,894. Total number of flowering plants, 95,620 species.

This "number is, of course, but a very rough estimate," says the *Gardeners' Chronicle*, "but the above is the number computed by taking the lowest number given under each order by the authors as being what they consider the probable number of species contained in it according to their view, though probably this number is not always intended as an accurate census even of their own views; and, if the estimate of other authors were taken into the count, the total number would be considerably augmented." Some of the largest orders are: compositæ, with 9,820 species; leguminosæ, with 6,504 species; orchideæ, with from 4,500 to 5,000; rubiaceæ, with 4,104; gramineæ, with 3,200; euphorbiaceæ, with 3,000; labiateæ, with 2,600; and liliaceæ, with 2,100. Then, in point of number of species, come sixteen other orders containing from 1,000 to 1,902. There are ten orders that contain less than five species, and one of these, batideæ, contains but a single genus represented by a single species. It seems that, of the flowering plants of the world, about one out of every ten species known belongs to the order compositæ. To this latter belongs the largest genus, that of *Senecio*, with 900 species.

"Among the curiosities in geographical distribution it is interesting to note the number of genera (about forty) that are common to tropical America and tropical Africa, and are found nowhere else, some of them genera of several species, in which case the bulk of them is confined to America, and only one or two occur in Africa, sometimes as distinct species, sometimes identical with the American species." . . . It seems "probable that the African species of these genera (*Copaifera, Drepanocarpus, Sparganophorus, Telanthera, Mohlana, Symmeria,* and *Calathea*) have been brought there by the agency of oceanic currents, winds, etc., from the American continent in bygone ages, rather than that the American species should have been derived from the African, as the numbers preponderate on the American side in all cases where the genus contains several species."

A New North American Fern.—Mr. Geo. E. Davenport communicates to the *Bulletin of the Torrey Botanical Club*, for June, a description, accompanied with a plate, of a very beautiful new fern—a species of *Cheilanthes*, which in honor of its discoverer he has named *Ch. pringlei*. This plant, which was detected by Mr. C. G. Pringle on the mountains of Southeastern Arizona, is said by Mr. Davenport to be, as a species, "one of the most distinct and satisfactory that has been discovered for a long time, and is wholly unlike any known to our flora or heretofore described."

A Large Shad Tree.—In the same journal G. P. Davis, M.D., mentions the discovery by him, in the town of Glastonbury, Conn., of a shad tree (*Amelanchier canadensis*) which had the size, proportions, and general aspect of an uncommonly fine old sugar maple. Its girth was found to be 8 feet 8 inches at 3 feet 6 inches from the ground, and the spread of its branches to be 48 feet in diameter. The tree was in full bloom on the 19th of May.

The Art which Produces a Cabbage.—At a November meeting of the Philadelphia Academy of Natural Sciences, Mr. Thomas Meehan exhibited a specimen of a cabbage which had, before blossoming, grown to the unusual height of three feet, the spiral coil of the stem, which was to the left, having been thus drawn out without any corresponding increase in the number of leaf scars.

The cabbage, in its natural condition, is an insignificant plant without any such head of leaves as makes it of commercial value when cultivated. The desired effect is produced by sowing the seeds of the wild cabbage at a period of the year so late as not to allow the formation of flowers, in which case the vegetative vigor of the plant is expended in the production of the mass of leaves, which become better developed and denser as the process of cultivation continues.

Sense of Direction in Animals.—The remarkable faculty which cats, dogs, pigeons, and other animals possess, of returning in a straight line to a point of departure, has awakened much curiosity on the part of naturalists. Some refer it to instinct, some to intelligence similar to that of man, some to an internal mechanism which makes the animals simply automata; but none of these attempted explanations does anything toward solving the mystery. Wallace supposes that when an animal is carried to a great distance in a basket its flight makes it very attentive to the different odors which it encounters upon the way, and that the return of these odors, in inverse order, furnishes the needful guide.

Toussenel supposes that birds recognize the north as the cold quarter, the south as the warm, the east (in France) as the dry, and the west as the moist. Recently, Viguier has published, in the *Revue Philosophique*, an original memoir upon the sense of orientation and its organs, in which he attributes the faculty to a perception of magnetic currents.

Influence of Electricity on Vegetation.—Mr. Macagno (*fide Les Mondes*) has experimented near Palermo upon the influence of atmospheric electricity on the growth of grape vines. Sixteen plants were submitted to the action of an electric current, by means of a copper wire inserted by a platinum point in the extremity of a fruit bearing branch, while another wire connected the branch at its origin with the soil. The experiment lasted from April to September. The wood of the branches which were experimented upon was found to contain less potash and other mineral matters than the rest of the vine, but the leaves had an excess of potash in the form of bitartrate. The grapes collected from the electrized branches furnished more mast, contained more glucose, and were less acid.

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Direct Process for Magnetic Iron Sand.

The production of wrought iron and steel from ore direct, without the intervention of the blast furnace, is a subject constantly occupying the attention of many metallurgists. In the blast furnace two operations are accomplished. First, the removal of the solid impurities in the ore used, by fluxes and in the form of slag. Secondly, the reduction of the oxide of iron it contains, by deoxidation, to the state of metallic iron. This combined operation with the common ores is very efficiently done in the blast furnace, but the resulting pig iron is somewhat impure, containing always a greater or less percentage both of carbon and silicon. For the production of wrought iron these substances have afterward to be removed by the operation known as puddling, which consists of remelting the pig iron with fresh portions of oxide of iron to oxidize and thus remove the carbon and silicon it contains. If, however, an ore of high percentage is taken, composed chiefly of oxide of iron, the production of metallic iron then consists almost entirely in the second process effected in the blast furnace; that is to say, the reduction of oxide of iron by deoxidation to metallic iron. This can be accomplished at a comparatively low temperature—about 800° Fah.—and a higher temperature is only necessary afterward to melt and agglomerate the particles of metallic iron thus formed.

The method of reduction usually proposed in all direct processes is by the admixture of solid carbon, in the form of coal or charcoal, with the iron ore, both being brought into a fine state of division by grinding, in order to cause an intimate mixture of the particles, and thus facilitate the chemical action which takes place. Numerous processes and forms of apparatus have been proposed to effect this object, but the practical difficulties have been threefold. First, the difficulty of bringing the heat to bear on a powder, which, owing, to the interstices between the particles, is always an exceedingly bad conductor of heat; secondly, the prevention of the particles of iron once formed being again reoxidized; and thirdly, the difficulty of getting rid of the solid impurities in the ore, which, when melted, form a highly acid slag, containing a very large percentage of iron.

One of the earliest attempts at the production of pure iron direct was by what is known as Blair's process, modifications of which have formed the basis of many subsequent attempts in the same direction. This process consisted of heating together a mixture of iron ore and charcoal, both finely powdered, in close retorts of peculiar construction. In this way the iron was reduced to a metallic state in the form of spongy iron, which was afterward agglomerated in a melting furnace. The process, however, was abandoned, owing chiefly to the difficulty of the proper regulation of the heat, which was either not sufficient to penetrate to the interior of the retort, or so great as to cause a partial melting of the mixture near the sides, which was afterward removed with difficulty. It was found also that unless the iron ore used was nearly pure, besides being free from phosphorus and sulphur, the loss of iron in the slag in melting was very great, and the quality of the iron itself was defective, being generally what is known as red short.

It occurred to Dr. Siemens that the chief difficulties in the direct process would be overcome by the use of a rotary furnace, which would accomplish the double object of thoroughly exposing the mixture of iron ore with coal or charcoal to the necessary heat by constantly turning it over, and also afterward agglomerate the particles of metallic iron formed in the furnace, by rolling them together while in a pasty, half melted state. In this way balls of metallic iron would be formed, exactly the same way as the operation is done by hand in an ordinary puddling furnace. After many experiments this furnace, which has been previously noticed in our pages, has been brought to work practically on a large scale. The third difficulty, however, was still experienced; the necessity of having, if possible, a pure oxide of iron, which by reason of its containing no solid impurities would form no slag. Attention has lately been turned to the magnetic iron sand deposits which exist in some places on the sea coast in large quantities, especially in Canada on the banks of the St. Lawrence, though generally on the portions of the river, so mixed with ordinary sand as to be with difficulty separated from it. Lower down the river, however, the deposits are more extensive and purer. At Moisic, near the bay of Seven Islands, according to the Geological Report of Canada, there is a continuous broad belt of iron sand on the surface of the beach, some three miles long, and several feet deep, containing equal to 55 per cent of metallic iron, with at the same time a total absence of phosphorus and sulphur.

The separation of these magnetic sands from all their impurities has been recently accomplished by a very ingenious invention of Mr. Edison. This machine is simply a hopper, fixed at an elevation, and so arranged as to allow the magnetic sand it contains, previously dried to prevent any cohesion of the particles, to fall from a long narrow opening at the bottom of it in a thin continuous stream. Electromagnets are placed at right angles to this stream, and so arranged as to simply deflect the grains of magnetic iron when falling, without allowing them to come in contact with the magnets. The magnetic iron thus falls into a receptacle at one side, while the impurities, consisting of sand, titaniferous iron, etc., fall in a direct line, and are thus separated. So complete is the arrangement that a single separator, requiring only a 3-horse power engine to elevate to the hopper and drive the dynamo necessary to supply the magnetic current, will pass through 70 tons a day of sand, giving a product, when fairly pure magnetic sand is operated upon, containing only about 2 per cent of impurity. If passed through a second time, an almost pure magnetic oxide is the result—that is to say, an article containing 72 parts of metallic iron, combined with 28 parts of oxygen. Some of this separated magnetic iron ore, containing about 2 per cent. of impurity, has recently been worked in the Siemens rotary furnace, at the works of the Landore Siemens Steel Company, with the following results:

After a few trial charges, to ascertain the best mixture and most suitable temperature for working this material in the rotator, it appeared that a charge of 25 cwt. of magnetic iron sand, mixed with 6 cwt. of small coal, or charcoal, gave the best results. The whole time required for the operation, from first charging the furnace to withdrawal of the rough, puddled balls, was on an average 3 hours 45 minutes. The yield, in the case of the small coal charges, was about 18 cwt. of rough balls; in the case of charcoal charges somewhat less, or about 16 cwt. The difference in weight may probably to some extent be accounted for by the impurities in the coal, and less perfect decomposition, as compared with the charges made with charcoal. The finished charges usually came out in the form of six or seven balls, some of them weighing over 3 cwt. They were mostly at once thrown, while red-hot, into the Siemens-Martin steel furnaces, and used for making mild steel, for which purpose they were found to be very suitable, and gave excellent results. One of the balls, however, from a charge made with coal, was roughly hammered into an billet, which on analysis gave: Metallic iron, 96·95; slag, 3·04; phosphorus, 0·002; sulphur, 0·03; carbonaceous matter, 0·17; manganese, trace. Probably the small quantity of phosphorus and sulphur contained in this sample was combined with the slag, and would be got rid of by reworking the billet in the usual manner. One of the billets from a charge made with charcoal was afterward reheated, and simply rolled into a finished bar, without piling and reheating again, as usually done. The bar thus obtained was of very fine quality of iron. Upon testing, the tensile strain was found to be 21·5 tons per square inch, with 23 per cent of elongation.

From these statistics it would appear that when working upon pure magnetic iron sand, each of Dr. Siemens' rotary furnaces would produce six charges daily, with a produce of five tons per day of rough puddled bars, or say about thirty tons per week of shingled blooms. The fuel used in the gas generator for heating the furnace comes to as nearly as possible one ton of coal per ton of puddled balls made; and the wages, when working the rotators in pairs, with proper mechanical elevators for charging, would be about six shillings per ton of rough puddled balls produced. It seems probable, from these experiments, that the manufacture of fine qualities of iron and steel will before long be carried out on a large scale in the Siemens rotator, and that pure magnetic iron sand will considerably assist in its economical production. The reduction of magnetic oxide of iron to metallic iron is accomplished more easily, and at a lower temperature, than sesquioxide of iron. Owing also to the fact of the magnetic oxide containing less oxygen than the sesquioxide, it requires less coal or charcoal in the process of reduction to metallic iron.—*The Engineer*.

The Ventilation of Public Buildings.

The failure of systems of ventilation and heating in public buildings is deplorable, not simply because of the injury done to the occupants of such buildings, but because of the influence such failures have in retarding the general adoption of better ventilation and heating for private buildings. If a free use of money with supposed scientific building cannot secure satisfactory ventilation, the argument is raised that a moderate outlay of money superintended by a house carpenter cannot hope to secure this desirable feature. There are valid reasons why buildings constructed at public expense should have the most approved ventilation and heating. That many of them do not, it is not necessary to say.

A common fault in the "system of ventilation" adopted in public buildings is the attempt to make one shaft, in which there is nothing to induce an upward current, remove the foul air from several rooms on different floors. The plan does not secure the most satisfactory removal of foul air from any room, and is fraught with danger because of the liability of the current's being reversed by the opening of a door or window in one of the rooms tapped by the shaft. The result is that the foul air from a series of rooms, instead of being carried out of and entirely away from the building, is carried into one room, the occupants of which may suffer unconsciously. This fault has been observed in a building in which the foul air ducts from a large number of offices and water closets opened into a common shaft tapping five floors. The result is, when the wind is in a certain direction, the foul air from a large number of offices and water closets is forced down the shaft into one room, or, possibly, all the rooms on one floor, from which it has no escape when the doors and windows are closed. The same result follows in buildings where the garret is used for a foul air chamber, into which all the foul air ducts empty, and from which exit is supposed to be provided by one or two large shafts through the roof. In a certain insane asylum, where the garret is used as a foul air chamber, in an examination of the working of the system, by allowing the handkerchief to float over openings of the ducts in the garret floor the handkerchief was drawn down into one of the ducts with great force. On seeking the cause of this reversal of the current, it was found that the patient in the room which the duct was supposed to ventilate had in the night broken the window of the room. The wind, blowing from the opposite quarter, immediately reversed the current, and the accumulated foul air from the garret above had for several hours been turned from its proper channel into the room of the patient.

The difficulties alluded to may be overcome by having a foul air shaft for each room, and having that shaft continue unbroken through and above the roof. In dormitories and asylums, where there are large numbers of rooms, and large numbers of shafts necessary, this may be done without sacrificing architectural beauty, by collecting a number of shafts together into a large, heated chamber, and provide their exits, still unbroken, through the roof, in such places as it may be desirable to maintain the harmony of the design.

A system of ventilation to be most successful needs to be most simple. Each room should have a complete system in itself, not dependent upon the conditions in any other room, so that it could not be deranged by any circumstance in other parts of the building.—*The Sanitary News.*

Increased Speed of Machinery in Factories.

The speed of cotton machinery in Lowell is said to have been increased 30 per cent within twelve or fifteen years. If the city contained no more spindles in 1883 than in 1873, therefore, the production of the mills would still be largely enhanced. In considering the condition of our various manufacturing interests, this matter of higher speed and increased capacity of machinery is, says the *Commercial Bulletin*, often lost sight of, but is certainly worthy of attention in seasons of over-production, like the past six months. There are about 12,000,000 cotton spindles in the United States to-day against 7,000,000 in 1870, but if the speed and capacity per spindle has increased even 25 per cent, the actual productive capacity of the mills has been more than doubled.

And not only has the cotton manufacturing capacity of the United States been more than doubled since 1870, but a glance at the amount of cotton actually consumed by our mills shows an almost equal increase. In the three years 1869, 1870, and 1871 there were consumed in the United States 3,219,000 bales of cotton, or an average of 1,073,000 bales per annum. For the ten months from September 1, 1882, to July 1, 1883, there have been taken for consumption by the spinners of this country 1,988,417 bales of cotton. Very moderate purchases during the next two months will bring the total up to 2,146,000 bales, or just twice as much cotton as was used in the United States in 1870.

In the woolen manufacturing interest very similar conditions are found to exist. A desire to diminish the cost of production has led to an increase in the speed of machinery, and an enhancement of the capacity of the mills in other directions. The loom which formerly run 50 or 60 picks per minute now runs 95 perhaps; and where 40-inch cards were used, many mills now have cards 60 inches in width and of proportionately increased diameters. And yet, in speaking of the number of sets of woolen machinery in the United States, we are accustomed to compare the figures of 1883 with those of 1873 or 1863, without paying attention to any increase which has occurred in the size of the cards or capacity of the machinery during this period.

The effect of lessening cost of production by means of increased speed and machinery of enhanced capacity is not unwholesome. It is in the interest of the consumers, and is therefore eminently altruistic in its tendency. We have merely referred to it as an incident which statisticians frequently lose sight of in calculating the capacities of our mills and factories.

The English Parcels Post.

On August 1 a new parcels post service will be begun, and there can be no doubt that the convenience to the public will be very great. At least the tradespeople throughout England seem quite jubilant over the new regulation. Parcels not exceeding 7 lb. in weight, 6 ft. in girth, and 3 ft. 6 in. in length, may, after that date, be sent by post, at very reasonable rates; and these are liberal dimensions. Nothing is excluded that a respectable person would wish to send, the prohibition only including a few articles damaging to the physical or moral health of the officials and recipients Grouse may be posted from Scotland on the 12th, and no doubt soon after the establishment of the parcels post, says a contemporary, many grouse will come southward.

Live animals and birds are very properly excluded; but a man may post a small leg of mutton or a few bottles of wine, if carefully packed up. An officer will be on duty at the counter of the post office, whose functions it will be to weigh parcels, inform the sender what stamps are required; and the rates "shall be paid by means of postage stamps affixed to such articles, and shall be verified by such officer." Parcels may be addressed to post offices "to be called for," but there will be a charge of a penny a day while they are in the custody of the office.

A Man-eating Mollusk.

A minute pulmonate, Cionella aricula, was not long since reported as occurring in myriads in the cavities of cancellate bones in a prehistoric British cemetery at Chichester. It has now been found of unusual size, by Director Eisher, in human skulls from comparatively recent interments at Bernberg.

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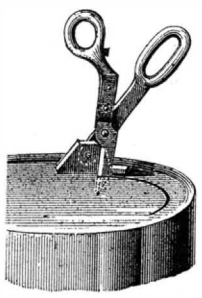
RECENT INVENTIONS.

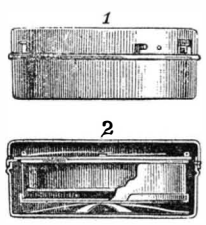
Can Opener.

The engraving shows an improved can opener which will cut on a straight or curved line. It is formed of two levers pivoted to each other, one being provided with a blade at its lower end, and the other having a plate pivoted to its lower end, and provided with a flange adapted to rest upon the top of the can, the plate thus serving as a guide and traveling fulcrum for the cutting blade. This useful invention has been patented by Mr. John McWilliams, of New Lebanon, N. Y.



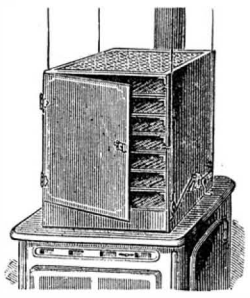
Watch Movement Box.

This is a box for packing watch movements for the market. It renders putting them up in paper unnecessary, and they are more securely held or kept from being shaken or injured. Ordinarily, in packing American watch movements for the market, they are put in a tin box and done up in paper, and then the whole put into another tin box provided with a cover. This invention consists in an inner and outer box and peculiar devices connected therewith, including a retaining ring, together with a spring forcing the watch movement against the ring, and locking devices, whereby a secure and steady packing of the movement is obtained. This ring, instead of being slipped to its place, as shown, may be hinged to one side of the outer box and fasten on the opposite side thereof, so as to open and close. If it be found that the ring mars the dial, a paper washer may be interposed between them. Such retaining ring may be used in connection with a permanently attached spring, instead of a removable one, for holding the watch movement up against it. Fig. 1 is an outside view, and Fig. 2 is a sectional view. This invention has been patented by Mr. Albert D. Bingham, of Nashua, N. H.



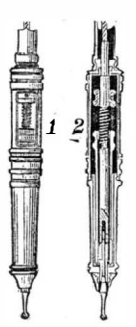
New Fruit Drier.

This is a metallic box having wire gauze top and bottom, and containing racks upon which to place the fruit. There is a hot air chamber below the wire gauze bottom, adapted to rest on or be suspended over the top of a cook stove by cords from the ceiling, which are attached to drums on the sides of the drier, so that by turning a crank the drier can be quickly raised up and suspended above the stove, when the latter is wanted for cooking purposes, without wholly suspending the drying process. With this kind of a drier the ordinary cook stove may be utilized for the heater without material interference with the cooking operations, and on the other hand the cooking operations will not materially interfere with the drier. A sheet metal slide is sometimes inserted under the trays to protect the fruit from the steam that may rise at times. It may also be placed over the trays to prevent the escape of hot air when desired. This invention has been patented by Mr. William F. Hale, of Jamestown, N. Y. (P. O. Box 1,914).



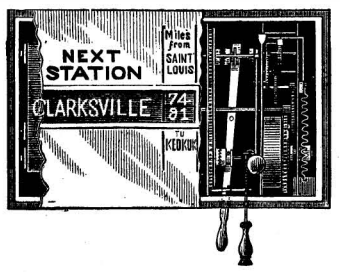
Dental Drill Hand Piece.

The engraving gives an external and a sectional view of an improved hand piece for dental drills, recently patented by Mr. Robert M. Ross, of 29 Columbia Street, Utica, N. Y. The improvement is designed to facilitate the insertion in the hand piece of tools having points of different sizes. In fact, the invention consists in the application to the hand piece of a simple and effective universal chuck adapted to the different shanks. The spindle proper is bored axially at the end, and mortised transversely to receive two tapered blocks which are grooved along their inner edges to receive the tool shank. Over the spindle is placed a sleeve with its lower end flared to receive the clamping block, and its upper end threaded internally, and fitted to the threaded portion of the spindle. The spindle is provided with a milled head by which it may be held while the sleeve is screwed down to clamp the blocks against the shank of the tool. The milled head of the spindle and that of the sleeve are accessible through slots formed on opposite sides of the handle, which may be closed by a rotating shell or cover. Besides this improved device for clamping the tool, the hand piece is constructed so that it may be very readily taken apart for cleaning. It has an improved swivel attachment at the top which connects with the flexible power connection. Further information in regard to this improvement may be obtained by addressing the inventor as above.



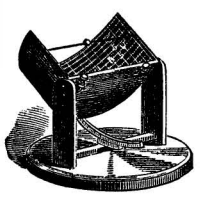
New Station Indicator.

This is a new device for showing successively the names of stations on a railroad, steamboat, or stage line, and calling the attention of the passengers to the apparatus by sounding an alarm. The invention consists in a station indicator having clockwork mechanism for operating rollers to which a band is attached, the band carrying the station names, so that when the clockwork mechanism is released the band will be wound from one roller to the other, and will be moved across a slot in the front of the station indicator box, and at the same time an alarm bell will be sounded to call the attention of the passengers to the station indicator. The rollers ar provided with clutching devices whereby the loose cogwheel (with which each roller is provided) of either roller can be engaged with a cogwheel operated by the clockwork mechanism, whereby the band can be wound in one direction or the other, according to the direction of the train. This invention has been patented by Mr. John W. Watts, of Clarkesville, Mo.



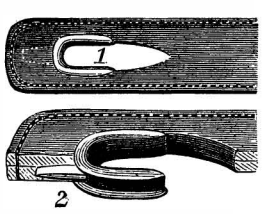
Improved Sun Dial.

This invention consists of a semicircular portion of a ring corresponding to that portion of the globe upon which the shadow of a ball located at the earth's center would travel, supposing the earth to be transparent, arranged in connection with a ball and an adjusting device, and having longitudinal lines of declination and transverse lines for hour-marks, making a simple and efficient sun dial or solar compass. The principle of the invention is as follows: Supposing the earth to be a transparent globe, with a ball placed in the center, then the shadow of the ball would travel around the globe once in twenty-four hours; and if the sun's declination was south, say, 10°, the shadow of the ball would travel 10° north of the equator. If we then take that portion of a globe lying 23° 28′ on each side of the equator, the extent of the sun's declination, with a ball in the center, and the upper half cut away, it would form a semicircular ring, on which, if suspended parallel to the equator, the shadow of the ball would travel as on the earth. If we make the ring flat, it will be the tangent of a globe of the ring's diameter, as shown in Figure, and if tangent lines of declination are drawn on this semicircular ring, with a ball suspended in the center, the shadow of the ball will travel along the line of declination all day if the ring is suspended parallel to the equator—that is, with an angle from the vertical equal to the latitude of the place. It is intended that cards with the sun's declination and equation of time should go with the instrument. This invention has been patented by Mr. Niles Larsen, of West Point, Neb.



Improved Trace Eye Guard.

The design of this invention is to strengthen the trace at the eye, where they receive the full strain of the trace, so that the trace will not tear out or break away in moving the load. The trace is made as usual with two or more layers of leather stitched together, and with an eye for the entrance of the whiffletree end irons. The trace eye guard is formed with flanges which are clinched on the sides of the trace, and a prong projects from the guard into the material of the trace, as shown in Fig. 2. The guard when applied is U-shaped, and is calculated to receive all of the wear and pressure of the whiffletree end irons. This invention has been patented by Mr. D. Kaltenbacher, of Shelbyville, Ky.

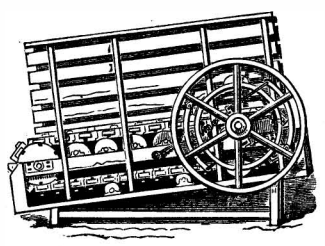


Novel Bicycle.

This bicycle has the cranks of the front driving wheel connected with hand levers pivoted in hangers on the vehicle frame, the hand levers being provided at their lower ends with arms carrying foot rests, whereby the levers can be operated by hand and foot. Elbow levers are pivoted on the same pivots with the hand levers, and can be connected with the same or with the fork of the steering wheel, so that, if desired, the elbow levers can be used for steering the vehicle by means of the feet, if the bicycle is to be propelled by means of the hands only. When the bicycle is to be propelled by means of the hands and feet, it is steered by means of a back rest attached to the upper swiveled end of the fork in which the steering wheel is journaled. This improvement has been patented by Mr. Jean B. Girard, of St. Aime, Quebec, Canada.

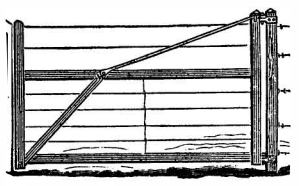
Improved Tread Power.

In this tread-mill power, the endless traveler consists of cast iron chain links jointed together and carrying lags which are connected to the links by a tenon on each end fitting in a corresponding mortise in the link. Carrying rollers are fitted to run in boxes attached to the frame, so that the chain links run along on them from one to another, and in order that the rollers may be of larger than ordinary size and placed further apart, the chain links have abutting shoulders above the pivot joints, which hold the lags up level for the horse to walk on. Each lag has a rib or cleat nailed on the upper surface just back of the front edge. The rollers that sustain the weight of the horse may be larger, stronger, and easier running than where the rollers are attached to the chains. For a brake to regulate the speed of the machine, a couple of centrifugal levers are pivoted to a couple of the arms of the flywheel, and having a brake-shoe on the short arm to act on a friction rim attached to the frame, the long arms of the levers being connected to the rocker bar by rods, and to the rocker one of the levers is connected by a coiled spring and adjusting screw, which tend to keep the brakes off the rim when the speed is not too high; but when excess of speed throws out the centrifugal levers the shoes will be pressed on the rim till the speed slows to the proper limit. The machine is provided with a simple stop device and is improved in other details. Mr. Lorin D. Carpenter, of Brush Creek, Ia., is the patentee of this invention.



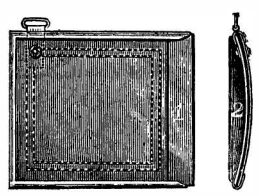
Improvement in Gates.

This gate is designed mainly for farm use; wood and metal or wire are combined in a novel manner in its construction. It may be cheaply made by unskilled labor, and combines lightness with durability. The gate is composed of two wooden uprights, one at the hinge end and the other at the free end, two horizontal rails and an oblique brace connecting the two as shown. An iron brace connects the upper end of the wooden brace with the upper end of the inner upright, and is provided with an eye which receives the pintle of the upper hinge. Wires are stretched between the uprights, forming a complete panel. This gate is very light and at the same time simple and strong. Mr. Carey McMillen, of New Guilford, O., is the patentee of this invention.



Blinder for Bridles.

The main leather part or body of the blinder is stitched or secured by rivets to the cheek pieces of the bridle in the ordinary way. At the upper, lower, and outer edges of the blinder are secured metallic binding, the edges of which are pressed down upon the material of the blinder, so as to grasp the edges of the blinder and finish it at the edges. The upper strip of binding has the slot formed in it near the outer edge of the blinder for the purpose of receiving the plate of the metal loop into which the blinder stay of the bridle is to be attached. This plate, after being forced down through the slot and between the two pieces of leather that compose the body of the blinders, is held there, preferably by the rivet which has the ornamental heads, as shown. The edges of the blinder may be finished with much less labor than by the old method of stitching, and the blinder is made much stronger, especially at the point where the loop for the blinder stay is attached, and is made more ornamental. Fig. 1 is a side view and Fig. 2 a sectional view of the blinder. This invention has been patented by Mr. Dominick Kaltenbacher, of Shelbyville, Ky.



PROF. S. A. FORBES has experimented with emulsion of kerosene upon the chinch bugs, says the *American Naturalist*, with good results. He finds that soap suds (one pound of soap to ten gallons water) mixed with an equal quantity of oil make a good emulsion. These fluids accomplish their work as well when poured on with a sprinkler as when applied forcibly in a spray, and kill the adult bugs as easily as the young.

THE *Railway Gazette* says that the tunnel contractors of the Pittsburg Junction Railway near that city are making bricks from the borings form the tunnel, to use them in roofing the completed tunnel. "Two wheels weighing several tons each work and pulverize slate, rock, and earth, and everything the tunnel produces. A stream of water is kept playing on the mass, and as it is pulverized it is forced through a fine sieve and carried to a chamber, where the manufactured clay goes through the regular process, producing a hard, tough brick."

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ENGINEERING INVENTIONS.

An improved car coupling has been patented by Mr. Abel W. Robinson, of Anna, Ill. A drawhead is provided with a bent plate, having a flange on its upper edge to support the coupling pin and kept in place by guide rods and pushed forward by springs, and the swinging apron hinged to the recessed forward end of the drawhead and resting against the guide rods. The coupling pin is held erect, when withdrawn from the coupling link, by a bent plate attached to the top of the drawhead.

A snow plow for removing snow banks from railroad tracks and designed to be attached to the front end of the locomotive has recently been patented. This plow is mounted on wheels and is provided with transverse and vertical cutters, which are driven into the side of the drift by the engine, and thus cut the bottom and sides of the bank of snow, after which a large hoe-shaped implement which is connected to the frame of the truck and operates similarly to a trip hammer is let fall and severs the block of snow, so that when the locomotive is backed the snow is loosened and will be thrown to the side of the track when the locomotive is again driven forward. Mr. Fielding Snedigar, of Elkader, Iowa, is the patentee.

MECHANICAL INVENTIONS.

Mr. John Schofield, of South River, N. J., has recently patented a signal car intended to run back from the rear end of a train to signal another train which may be following, and thus prevent accident. The signal car is also provided with a device for drawing it back to the railway car after it has performed its signaling mission.

Mr. Horace Woodman, of Saco, Me., is the patentee of an ingenious machine for stripping the top flats of carding machines. By the new machine the use of cams in the machinery for stripping the flats of carding machines is entirely done away with, and it is believed to possess several other advantages over the ordinary methods of treating fibrous substances before weaving them into cloth.

Messrs. J. A. Lesourd and James Lotan, of Portland, Oregon, have recently patented an endless chain carrier and distributer, etc., mainly designed for conveying and distributing coal; but it is equally applicable for conveying and distributing other materials. It consists in an endless chain carrier and distributing devices connected, whereby a continuous floor surface and easier running action are obtained for the carrier. Provision is made for varying the places of distribution.

An improved straightway valve has recently been patented by Mr. Bartholomew J. Kelly, of Troy, N. Y. This invention relates to straightway valves for controlling the passage of water, steam, and other gases or fluids in which opposite gates or valve disks are used, which are capable of being raised or lowered and of being forced apart against their seats. By this construction of independent gates the wear is distributed all around the surfaces of contact of the seats.

A machine which is designed to improve the quality of felted hat bodies and lessen the cost of manufacture has been patented by Mr. C. G. W. Purdy, of Brooklyn, N. Y. The chief advantage of this machine is that the felt becomes so thoroughly worked that there is comparatively little loss. Several rollers are mounted upon a vibratory carriage, and a roll of hat bodies is placed in one of the compartments of the carriage, each one of which is provided with a roller, and the felt is then rolled back and forth upon the slotted platform by the vibrating movement of the carriage.

Mr. Erastus Hibbard, of South Barre, N. Y., has recently patented a machine for finishing staves, so that when the barrel or tub is set up and trussed it is ready to receive the head without the use of the usual hand tools for leveling, chamfering, and crozing. Further, the object is to give uniform depth of croze in barrels having staves of varying thickness, instead of making the croze too deep in thin staves and too shallow in thick ones, as is generally the case in hand work. A revolving mandrel carries the tools, and a feed bed with traveling belts carries the staves. The parts are made adjustable and self-adjusting, according to the thickness of stave.

A very simple machine for cleaning and separating wheat, corn, oats, etc., has recently been patented by Mr. D. P. Motley, of Rexburg, Va. The wheat passes from a hopper into a sieve which is shaken laterally, and which is provided with thin strips which rise and fall between the wires of the screen and serve to separate the wheat from other matter, the dust and imperfect seeds falling through into the fan chamber below, while the worthless material is carried above the grain to the outlet, where it is discharged. The perfect grain in the mean time has fallen on to a secondary sieve where it is further cleansed by a blast from the fan blower. The seed is then passed into a scouring fan chamber and a polishing device, which finishes the separating and cleaning process.

A novel steam road vehicle has been patented by Mr. George A. Long, of Northfield, Mass. This invention consists in a tricycle or similar vehicle, in which steam is employed as the propulsive power, the large wheels being used as the drivers and the two small wheels as the guide wheels. The power is applieddirectly to the periphery of the driving wheels, by means of differential friction wheels, which work interchangeably on the periphery, and by this arrangement the inventor claims that a great amount of work may be accomplished with a minimum of power. The fuel used for generating the steam is preferably gasoline, but other substances may be used. The vehicle is provided with seats, and the invention seems to provide a very comfortable, efficient, and inexpensive mode of traveling.

An amalgamating apparatus to be used in either wet or dry placer diggings has been patented by Messrs. William Hawkins and Henry R. Hawkins, of Oregon, Mo. The amalgamator is provided preferably with two flumes which are arranged within the frame of the machine, and are oscillated by a crank and rack and pinion movement. The flumes are furnished with a series of troughs, supplied with the mercury for gathering the gold. These pans are furnished on the upper edges with projections, which prevent the mercury from being forced out of the pans by the reciprocatory motion of the flumes. A blower is provided, which, in case the machine is to be used as a dry amalgamator, blows all quicksand and other light matter out of the mercury pans, and keeps them clear and unobstructed; and in the wet amalgamator the blast of air serves to agitate the pulp and carry away all light refuse matter, leaving the blacksand, gold, and mercury in the pans.

AGRICULTURAL INVENTIONS.

Mr. Rufus R. Tugwell, of Brownsville, Tenn., has recently patented an improvement in hand power cotton presses which is both simple in construction, easily operated by one or two persons, and withal cheaply made. The principal parts of the machine are of wood, and the press may be constructed by a carpenter or by one even quite unpracticed in the use of tools.

Judging from the drawings and description in a patent recently issued to Messrs. G. J. Contancin, J. M. Scott, and J. Stumpff, of Blue Mound, Ill., for a corn stalk cutter, we should imagine that they have a machine which will prove valuable to all corn growers, and specially in the West, where such immense fields are planted. This machine cuts the stalks while standing in the field into such lengths that it will not interfere with the subsequent cultivation of the land, and is so arranged as to cut two rows of stalks at a time.

An improved cotton chopper and scraper has recently been patented by Mr. William R. Russell, of Big Valley, Tex. The plows are so arranged that the ground will be scraped upon each side of the row of plants. A stock is provided for enabling the rider to raise the plows from work when not required, and holding them above the ground in turning corners, etc. The choppers are mounted upon a longitudinal shaft, which is rotated by the hind axle of the machine. The machine is very simple in its construction and operation.

A cotton chopper has recently been patented which embraces some improvements over those heretofore in use. The machine consists in a chopping wheel which has two or more wide radial slots, so that when the machine is passed over the plants the latter will be left standing at certain equidistant intervals, while the plants between will be crushed by the roller. Side rollers are likewise provided for crushing the straggling stalks, and plows are arranged at the rear of these to throw up the soil around the standing cotton plants. The inventor is Mr. Richard R. Pace, of Lineville, Ala.

A light, cheap, and simple steam plow, in which rotating screw-shaped pulverizing blades are used, has recently been patented by Mr. G. W. Ross, of Bluffdale, Ill. The front and rear pulverizers are driven from a shaft which carries the driving wheels of the machine at a greater velocity than is due to their mere travel over the ground, and they are so arranged as not to interfere with the use of the engine for thrashing or general purposes, when not required for plowing. By setting the points of the blades of the pulverizers at a slightly acute angle of rotation, they will be kept sharp by friction with the ground.

An improved harrow has recently been patented by Mr. John C. McDorman, of Gilbert's Mills, O. This invention consists in connecting two triangular harrows with a central draught beam, and the special advantage of this arrangement is that when a stump, stone, or other obstacle is encountered, the side of the harrow nearest the obstruction may readily be raised for avoiding the same, and further, when the harrow is to be transferred from one place to another, the central beam may be raised and retained in its raised position by passing a beam through the bars of the two side sections, so that the harrow may be dragged like a sled, without the teeth coming in contact with the ground.

MISCELLANEOUS INVENTIONS.

Mr. Henry E. Finney, of Las Vegas, New Mexico, has recently obtained a patent on a catheter which is claimed to possess several important advantages over the instruments in general use.

Mr. W. S. Foster, of Richford, Vt., has recently patented an improvement in a double pull for gong bells, for use in situations where the connections extend in opposite directions or at right angles to each other, so that the same bell may be rung from separate places.

A baggage check has recently been patented by Mr. J. A. Thompson, of Monticello, N. Y., which is made in two parts hinged together at one end, while the strap passes through in the ordinary way. By reversing the sides at the end of a journey, the same check is ready to be used for the return trip.

A burial casket has recently been patented which is constructed in sections, so that it may be readily taken to pieces for transportation or for packing away in a small compass. Messrs. G. W. Comee and Samuel S. Comee, of Waseca, Minn., are the inventors of the "knock down" burial case.

Mr. Walter T. Armstrong, of Andes, N. Y., has obtained a patent for a machine for tinners' use for notching or cutting sheet metal in the manufacture of tin or copper vessels, cans, etc., in which the sheet has to be notched for forming the corners of the article properly.

An improved rake for use on lawns has been patented by Mr. James R. Benton, of Oswego, N. Y. The rake proper is carried by a frame which is mounted on rollers, so that it gathers up leaves and other refuse without injury to the sod. The box is made of a size suitable for holding a large quantity of leaves.

Mr. Jacob Rhoads, of Watsontown, Pa., is the patentee of a removable lip for cups or bottles. The lip is of the shape of the lip on the ordinary measuring vessel, and it is attached to the can or bottle by an elastic band, or the lip may be of itself elastic, and made to stretch over the top of an open vessel, for preventing the spilling of liquids in pouring.

Letters patent have recently been granted for an improvement in the shifting rails for wagons. This device is constructed in such a way that it may be attached to seats of different size, furnishing said seat with a comfortable back, and with devices to which may be attached a standing top when desired. The patentee is Mr. Andrew F. Shuler, of Arcanum, O.

An improvement in die and die block for forge hammers has recently been patented by Mr. J. H. Baker, of Westville, O., which consists of a locking device for holding the stock in the die while being forged, and a shifting contrivance of the die block for moving the stock under the hammer, and for widening or plating out the stock.

An oil burner for lamps where the oil is supplied from a reservoir and intended to secure safety has recently been patented by Mr. J. J. Miller, of Chicago, Ill. By this invention a continuous and uniform supply of oil to the burner is secured, the same being heated to a suitable degree for combustion by the burner through deflectors.

An improved nut lock has recently been patented for securing fish plates to railroad rails. The special feature of this improvement consists in the manner of locking the nut securely, so as to prevent it from becoming loose by the jarring of the rail. The inventors are Messrs. J. B. Greenhalgh and Henry Greenhalgh, of Blackstone, Mass.

Mr. Samuel E. Nutting, of Iron Ridge, Wis., is the patentee of an improved seal lock which is so constructed that the locking bolt may secure the door of the car. A thin metal strip or wire passes through slots in the hasp and through the locking bolt, and the hollow cylinder holding them all securely in place. The ordinary seal with the name of the station or other device stamped thereon is used.

Mr. Alonzo Chappel, of Brooklyn, N. Y., has patented an instrument which he has named a "linearscope," which is used for obtaining the correct outline of objects and forms within the space of an intended picture, thereby avoiding the uncertainty of perspective points taken by the unaided eye. This instrument will be found of great convenience for artists and amateur draughtsmen.

A very simple and practical glue heater has been patented by Mr. W. C. Weatherly, of Grand Rapids, Mich. The invention consists of a glue heater or pot adapted to be used with a heating chamber and made adjustable upon it, so that the temperature of the pot may be regulated with great accuracy, by increasing or diminishing its contact surface with the heating chamber.

Mr. Watson F. Hammond, of Mashpee, Mass., has obtained a patent for an improved machine for screening cranberries. This machine consists of a hopper into which the berries are to be placed, suitable valves for regulating the discharge from the hopper, a screen for separating the perfect from the imperfect cranberries, and a delivery spout for discharging them into boxes or barrels preparatory to shipping them to market.

A practical device for turning wrist pins has recently been patented by Mr. Francis M. Hazleton, of Red Bluff, Cal. The invention consists in bearing blocks or boxes fitted with cutters, which blocks are to be applied to the wrist pin and the shaft or wheel then revolved, and thus, by the internal cutters, will true the journal in the exact position in which it has to run, the journal being revolved in the cutter box the same as it usually revolves in its own box.

A simple device for gauging weather or clap boards has been patented by Mr. J. C. McEwen, of Lochloosa, Fla. The device may be readily set for indicating the inclination and set of the board, and it is readily adjustable for boards of different widths. This implement may be provided with hooks upon which may be hung the various tools used by the workmen, which will thereby be always readily at hand convenient for use.

A simple device for ascertaining and verifying the inclination of ditches, etc., has been recently patented by Mr. Lyman F. Pontious, of Adair, Ill. A spirit level is mounted upon a stock which is supported by stakes driven in the ground. The angle is obtained by sighting with the stock, and the degree of inclination is indicated by the spirit level. When this has been ascertained, the stock may be laid on the bottom of the ditch, to gauge the inclination of the latter.

Mr. H. C. Richards, of Cincinnati, Ohio, has patented an improved stringing bar for pianos and other musical instruments. This invention permits metallic fastenings at both ends of the strings as well as connects them by certain devices which allow them to be tuned with greater facility than in the ordinary way, and doing away with all wooden support, and is consequently much less affected by atmospheric changes.

An improved leveling instrument which combines the elements of simplicity and accuracy, and which at the same time is quite inexpensive, has been patented by Mr. Jefferson A. McCurry, of Whitesville, Ga. The special object of the invention is to have a cheap instrument useful for "laying out" terraces, ditches, etc., but at the same time it is capable of performing the ordinary functions of the more elaborate and costly instruments.

Mr. Foree Bain, of Minneapolis, Minn., has recently patented an improved dynamo electric machine. The invention relates to the construction of the armature cores, the object being to prevent residual magnetism and to obtain the maximum of saturation of the armature and its quick discharge. In this invention an armature core is formed of a sheet metal ring, with a vitreous surface coat, and having outwardly extending opposite tongues, with annealed iron wire wound between them.

To protect the sole of shoes from wear, Mr. S. M. Street, of Dalton, Ga., has patented the following method. On either side lengthwise of the sole, the inventor places screws at short intervals, leaving the heads of the screws projecting from the surface of the leather; across the sole of the shoe he passes a wire back and forth around the heads of the screws, forming when completed a web of wire across the entire bottom of the shoe, protecting the leather and rendering the sole very durable.

A patent has recently been issued to Mr. W. H. Wolfrath, of New York city, for an improvement on a sash fastener granted to the same inventor on March 8, 1882. The present invention consists of an ingenious arrangement by which, in the act of raising the window by the sash lift, the sash becomes automatically unlocked; a connecting rod between the window lift and fastener operating a cam contrivance does the work. As soon as the pressure on the sash lift is removed, the window becomes locked again.

Some improvements in the process of milling flour by feeding the grain between rollers has recently been devised. Mr. Oscar W. Tresselt, of Fort Wayne, Ind., is the patentee of certain improvements in the arrangement and adjustment of the rollers, whereby grain may be ground to any degree of fineness desired. Provision is also made for allowing the rollers to separate and allow stones, or any substance too hard to be crushed, to pass between the rollers without injury to the latter.

An apparatus for sampling ore, concentrates, tailings, placer gravel, or other minerals for ascertaining their value has been patented by Mr. George S. Andrus, of Columbia, Colo. A series of chutes are arranged within a case beneath the pulverizer, and so arranged one above the other that half of the material will pass to the inside of the case and thence to the hopper, and the remainder drops into the second row of distributers, and so on, until the lower chutes are reached.

Mr. J. Edwin Giles, of Hazleton, Pa., has obtained a patent for an improved dynamo electric machine. In machines as heretofore constructed a large increase or decrease in the strength of the current is necessary before there is any action of the regulating mechanism, while by this improvement the mechanism acts automatically and maintains the current at its normal strength. The inventor locates the commutator entirely or partly within the core, thus economizing space, and permitting a core of greater length and hence of greater strength being used.

Mr. Oliver Pelkey, of Arnot, Pa., is the patentee of an improved brake for sleds. The fore part of the sled is provided with a horizontal tongue-roller furnished with pivots which slide in horizontal slots, so that when the sled is on an incline and slides ahead of its own gravity it overruns the pivots on the tongue-roller, and the brakes are thereby automatically set; the metal nose on the lever extending from the brake impinges in the ice. The action is very simple, and the brake is as applicable to a pair of tandem bob sleds as to any other.

The ordinary charcoal furnaces used by plumbers are among the most dangerous articles used about houses. They have been the cause of a great many disastrous fires. To obviate the dangers attendant upon the usual plumber's furnace, Mr. Leopold Bowsky, of New York city, has patented an improvement by which greater security against fire is insured, while its construction warrants a quicker heat and better combustion. The inventor claims that his furnace may be set upon the finest rug or carpets while in use without doing them injury.

A boiler hoe intended to scrape a large surface of a boiler at once is the subject of letters patent recently issued to Mr. James Preston, of New York city. The hoe consists of two wings pivoted to a block attached to a rod, whereby the wings can be passed into the boiler through the hand hole while folded and spread ont when within the boiler. This is accomplished by drawing the blocks toward each other and locking them in position by a nut, thus forming an effective instrument for cleaning the inner surface of boilers.

Among the recent improvements in dumping scows is the patent of Messrs. John Smith and John P. Rhodes, of Rockville Center, N. Y. The body of the scow is made in two halves which are hinged together at the upper edges, the receptacle for the garbage having inclined sides, so that when the two sections are unlocked the weight of the load will press the two sides open and discharge it into the water. A locking device is also provided for holding the sections apart while the load is being discharged, and when this is accomplished the buoyancy of the sections will bring them together again as soon as the lock is released.

Mr. Mason L. Cope, of Denton, Texas, is the patentee of an improved gate so constructed that it may be opened without the necessity of the driver descending from the carriage. The gate is mounted at the middle on a vertical post pivoted at top and bottom in suitable bearings, which enables the gate to swing open and shut on its vertical axis. One of the bars of the gate is made to serve for the latch by being fitted to rise and fall, and being connected with levers mounted on the central post to be conveniently reached by persons riding in carriages for opening and closing the gate without the necessity of dismounting.

A cheap paint for roofs and like purposes consists of Venetian red mixed with petroleum tar, cod oil, lime water, resin oil, pulverized copper, ground alum, glue, and China clay. These ingredients form a mixture which it is claimed will last well and resist the action of heat, and protect buildings from burning embers. Mr. A. G. Peuchen, of Toronto, Canada, is the patentee. The same inventor has also obtained a patent, of same date, on another paint composition consisting of boiled linseed oil mixed with silicate of soda, naphtha mixed with alum, a potash solution, raw linseed oil and resin, and cod oil mixed with brown japan. The patentee claims for this paint cheapness, quick drying, hard finish, easy to work, and not liable to crack or peel.

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Business and Personal.

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Hollar's Safe and Lock Co., York, Pa., manufacturers of improved Fire and Burglar-proof Safes, Bank and Safe Deposit Vaults and Locks. See adv. p. 61.

25" Lathes of the best design. Calvin Carr's Cornice Machinery. G. A. Ohl & Co., East Newark, N. J.

For Sale.—Engine Lathes. One 16" x 6' Blaisdell, 2d hand; one 18 x 6 Lodge & Barker, hollow spindle, new; also one each, 8', 10', and 14' x 21", Steptoe make, new. Each lathe complete. Jno. Steptoe & Co., 214 W. 2d St., Cincinnati, O.

Drop Forgings. Billings & Spencer Co. See adv., p. 45.

Wanted.—A good draughtsman and pattern-maker for modern engines. Adolph Leitelt, Grand Rapids, Mich.

Equatorial Silvered Glass Telescopes, 5½" aperture, $135; 6½" aperture, $175; 7½" aperture, $225; 7½" aperture, $275. Eye Pieces and Finder. J. A. Brashear, Pittsburg, Pa.

Unfailing water power, buildings, and planing mill plant. Best point for manufacturing and shipping. Very cheap. J. F. Palmer, Auburn, N. Y.

The Ide Automatic Engine, A. L. Ide, Springfield, Ill.

Steam Pumps. See adv. Smith, Vaile & Co., p. 30.

Contracts taken to manuf. small goods in sheet or cast brass, steel, or iron. Estimates given on receipt of model. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 35 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

Engines, 10 to 50 horse power, complete, with governor. $250 to $550. Satisfaction guaranteed. More than eight hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Best Squaring Shears, Tinners', and Canners' Tools at Niagara Stamping and Tool Company, Buffalo, N. Y.

Lathes 14 in. swing, with and without back gears and screw. J. Birkenhead, Mansfield, Mass.

The Best.—The Dueber Watch Case.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent Agency, 261 Broadway, New York.

Farley's Directories of the Metal Workers, Hardware Trade, and Mines of the United States. Price $3.00 each. Farley, Paul & Baker, 530 Market Street, Phila.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Lists 29, 30 & 31, describing 4,000 new and 2d hand Machines, ready for distribution. State just what machines wanted. Forsaith & Co., Manchester, N. H., & N. Y. city.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N.H.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street, P. O. Box 3083, New York city.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

The Sweetland Chuck. See illus. adv., p. 46.

Improved Skinner Portable Engines. Erie, Pa.

Catalogues free.—Scientific Books, 100 pages; Electrical Books, 14 pages. E. & F. N. Spon, 35 Murray St., N. Y.

Am. Twist Drill Co., Meredith, N. H., make Pat. Chuck Jaws, Emery Wheels, Grinders, automatic Knife Grinders.

American Fruit Drier. Free Pamphlet. See ad., p. 62.

Brass & Copper in sheets, wire & blanks. See ad. p. 60.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 61.

Our goods rank first for quality, safety, and durability. Please compare them with any other make, and is not found better and cheaper, quality considered, we will bear the expenses of the trial. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co. Hartford, Conn.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 62.

20,000 Duc Spherical Elevator Buckets, sizes 3½ to 17 inches, constantly on hand. Telegraphic orders filled. T. F. Rowland, sole manufacturer, Brooklyn, N. Y.

Straight Line Engine Co., Syracuse, N. Y. See p. 61.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

NEW BOOKS AND PUBLICATIONS.

PSYCHE, A JOURNAL OF ENTOMOLOGY. Published by the Cambridge Entomological Club, Cambridge, Mass.

This periodical is in the tenth year of its publication. The editor and his associates are entomologists of standing, four of them being appointed by State governments and one is assistant entomologist to the United States Department of Agriculture. The object of the periodical is to give valuable information useful to agriculturists on the habits and lives of insects injurious to vegetation. The indices to each number form a synopsis of entomological literature for the period and scope they cover.

DAS ELEKTRISCHE LICHT (ELECTRIC LIGHT). By Dr. Alfred von Urbanitzky. Wien, Pest, Leipzig, 1883. 218 pages.

In this work the author gives a description of the various kinds of electric lamps, the theory of the incandescent lamp, the theory of the arc lamp, the temperature, and the strength of the light. He then describes various means of subdividing the current, the loss of the current caused by the subdivision, etc. Then follow the lamps and carbons. He divides the incandescent lamps into two classes, those having imperfect conductibility, such as the lamps of Edison, Maxim, Swan, etc., and into incandescent lamps with imperfect contact, for instance, such lamps as the Reynier, Werdermann, Hauck, etc. He describes the different systems of arc lamps, the various kinds of carbons, the method of manufacturing the carbons, and finally describes the lamps having inclined carbons. This work is the third volume of Hartleben's Electro-Technical Library.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) J. H. P. asks for the French formula of making a hektograph, which for several reasons, we understand, is superior to any other in use. A. The composition is;

Good ordinary glue	100 parts.
Glycerine	500 "
Barium sulphate finely powdered	25 "
(Or the same amount of kaolin.)	
Water	375 "

(2) E. S. R. writes: I have about 4 dwt. of 10 k. gold dissolved in nitro-muriatic acid. What can I use to precipitate it so I can prepare it for electroplating? A. Evaporate to crystallization and dissolve the resulting chloride of gold in water. It may then be used for plating. Iron sulphate will precipitate the gold as metallic powder.

(3) L. T. S., of Launceston, Tasmania, proposes freezing out yellow fever and similar diseases by converting a dwelling or hospital into an immense refrigerator by means of ice. This would not be practicable except in a building specially constructed for the purpose.

(4) A. writes: 1. I have two cisterns; the water is full of little mites or lice; sometimes they are almost invisible, then they get larger till they show very plain; but what finally becomes of them or where they come from I do not know. What are they, and what will destroy or keep them out? A. The larvæ of mosquitoes, flies, and other insects infest cisterns that are open to the air or dirty. Cleanliness and closing the top with a stone or earth will generally keep the water free from larvæ. 2. Is it so that a lightning rod can be dangerous? I have supposed that if insulated it neither attracts nor repels, and if not insulated it must transmit a portion of the charge, according to capacity; if the connection is perfect, the rod large enough, and the ground sufficient, the entire charge. A. Lightning rods are dangerous to persons near them in thunderstorms. They are liable to be overcharged. 3. You always say "solder" all connections. Now, isn't there some mistake? Is not solder a poorer conductor than iron, and would not the simple contact of the two ends be better than to fill between with solder? Or if the conductor is flat, say ½x1½ inches, would it not make a better joint to lap and bolt or rivet the ends together. A. Solder, because it is very sure to make a perfect connection. Riveting with copper rivets is also good, but should be well done with two or three rivets.

COMMUNICATIONS RECEIVED.

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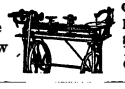

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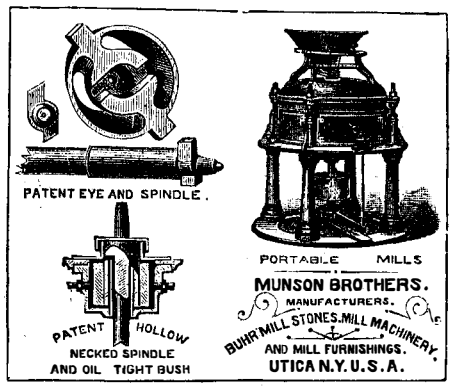
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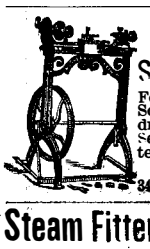

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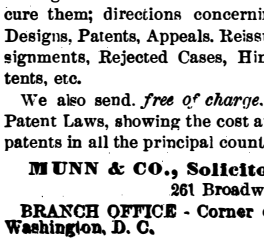

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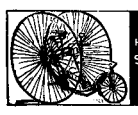

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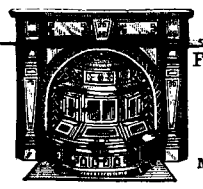

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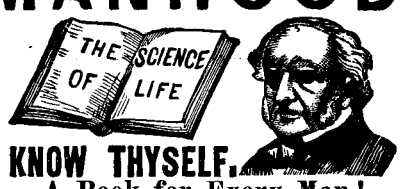

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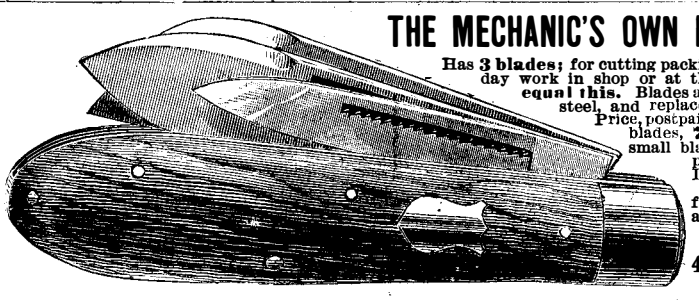

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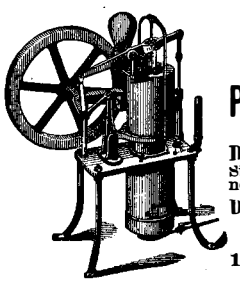

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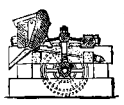

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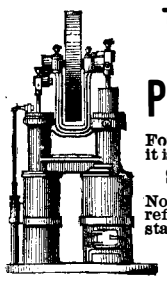

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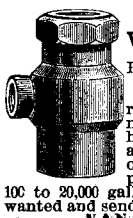

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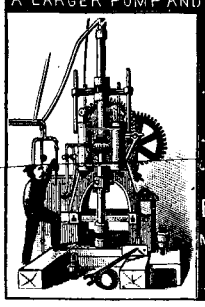

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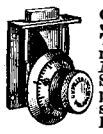

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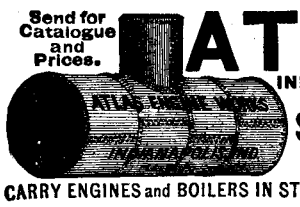

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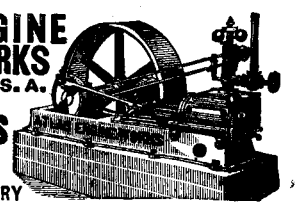

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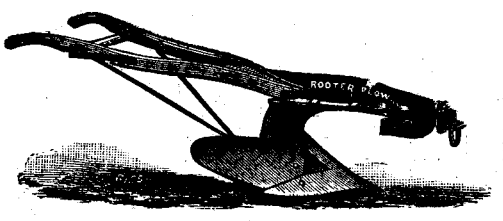

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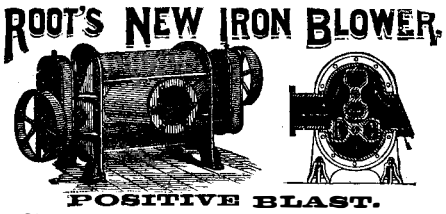

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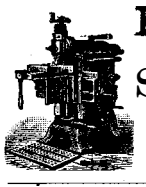

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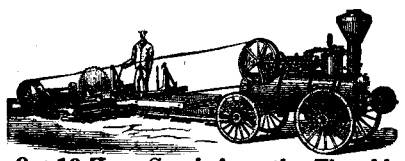

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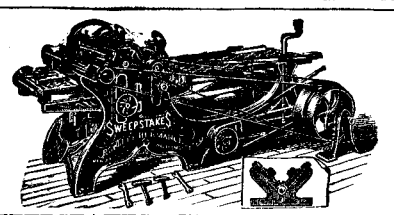

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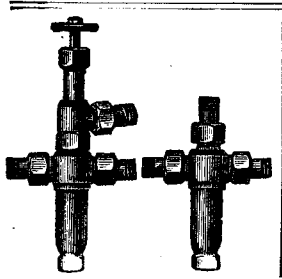

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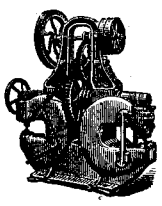

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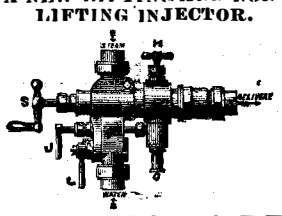

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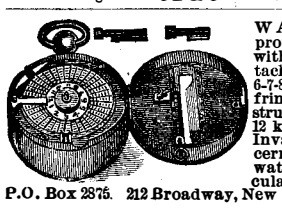

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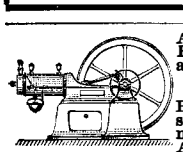

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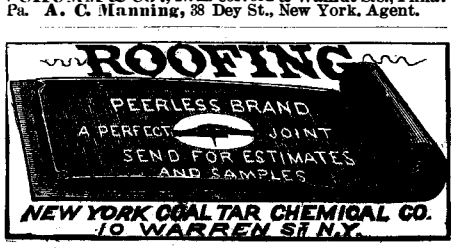

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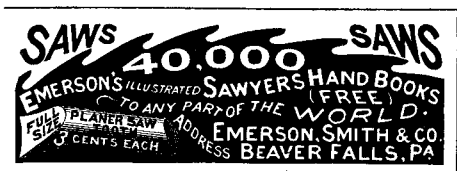

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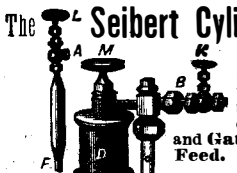

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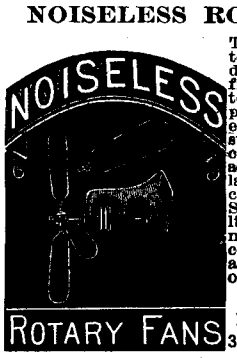

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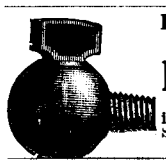

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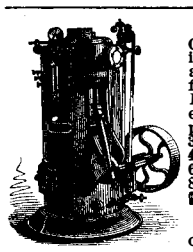

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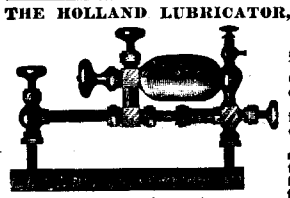

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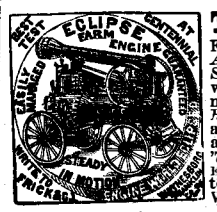

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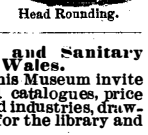

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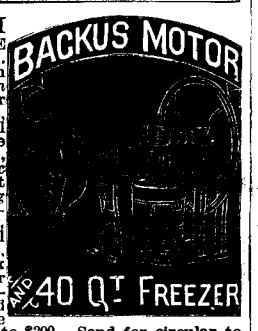

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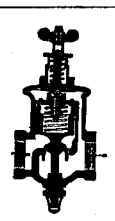

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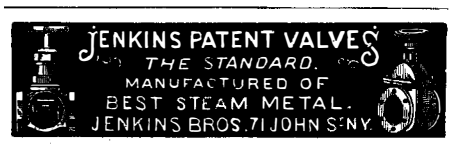

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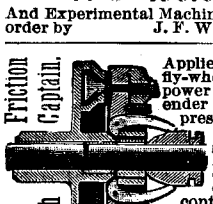

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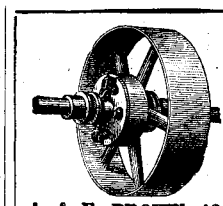

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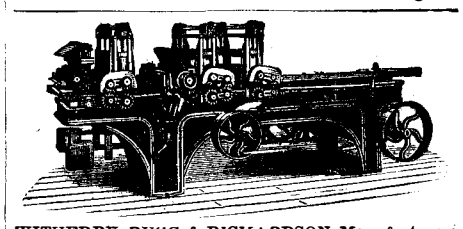

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